SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE FUR-SEAL INVESTIGATION OF 1896.

THE preliminary report of the commission appointed in June, 1896, to investigate the condition of the northern fur-seals has recently been issued, although it has been in print for some time. It gives a resumé of the summer's work and of the conclusions reached, and will be followed later on by a full report giving in detail the observations and facts on which this summary is based. The work was prosecuted under exceptionally favorable conditions, not only from the facilities afforded the commission, but from the number of observers engaged, since what was not seen at one time or place might be seen at another, while the representatives of the various governments worked harmoniously together in the accumulation of data. Much, too, is also due to the thorough manner in which the work was planned and carried on by Dr. Jordan, the head of the American commission, while finally the reduced number of seals facilitated the work of observation.

We have for the first time a fairly accurate census of breeding seals, based not on estimates, but on an actual count of females and males present on the breeding grounds, checked by comparison with the number of young seals present. This last is an important factor, since a count of the pups shows that only about one-half the females are on the rookery grounds at any one time. While an *exact* census is, from the nature of things, impossible, it appears that there were in October, 1896, a little less than 360,000 seals left on the Pribilof Islands, 123,000 being breeding females, 5,009 males with harems, and 2,966 idle bulls, or those which were unable to secure any females through the scarcity of those due to pelagic sealing.

The breeding habits of the seals were carefully studied and the facts definitely settled that the young 'cows' make their appearance on the rookeries for the first time at the age of two years. This occurs late in July, after the vast majority of young have been born and the breeding grounds or rockeries have lost the compact appearance they present earlier in the season, and the arrangement of the females in regular fixed harems has been broken up; the young females are not in the harems with the older cows. Mr. Townsend's investigations of the condition of female seals taken at sea were continued and extended and fully corroborate his conclusions that, with rare exceptions, all over two years old taken during August and September are not only pregnant but nursing. The statements that the females taken at sea are largely barren or non-breeding are unsupported by any shadow of evidence, as are the assertions that the fur-seal breeds biennially, all observations proving that seals bear annually and throughout life.

Some additions have been made to our knowledge of the food of the fur-seal, although the data for this have mostly been obtained by Mr. Townsend and Mr. Alexander in previous years. In Bering Sea the Alaskan Pollack (*Pollachius chalcogrammus*) forms by far the most important item of the seal's diet, a squid (*Gonatus amœnus*) coming next. Salmon are eaten when found, and large numbers of a small, undescribed fish, allied to the Surf Smelt (*Hypomesus olidus*). Cod are not touched, at least in only one case out of three hundred, nor any species of bottom-frequenting fish, the seals feeding on such as are found near the surface, while the feeding grounds are in deep water. In regard to the young it is clearly shown that up to the time of leaving the islands they subsist entirely on their mother's milk, deriving no nourishment from fish or crustaceans, much less if the hibernicism be allowed, from kelp or sea weed. Thus every seal pup whose mother is killed at sea inevitably perishes from starvation, even the largest gray pups being unable to care for themselves late in October.

An important feature of the work of the commission was the ascertaining of the fact that a large number of seals die when very young and the reason for this loss of life. It has been generally considered that *all* seal pups which have been found dead of late years have starved to death on account of the loss of their mothers from pelagic sealing. On the other hand, the English commissioners in 1892 took the ground that there was a considerable loss from other causes, particularly drowning and epidemics. As a result of the investigations of 1896, it is now known that many young seals die before they are a month old and prior to the date on which pelagic sealing begins, through being trampled on by the old seals and mainly by the bulls. This loss does not take place all over the breeding grounds, but is almost wholly confined to those sections which are level or free from boulders. In such places there is no

protection for the young and no obstruction to the movements of the adults, and in consequence there is great loss of life through the quarrels of the bulls and the commotion thus caused among the others, during which the small pups are trampled under foot and many killed. In rocky places there is little loss, and about a fortnight or so after birth the pups draw out of the breeding grounds and are comparatively safe. A few young seals are drowned and a few die from disease or are killed by accidents, and a few starve from the death of their mothers and other unknown causes, but the number is not great and there is no evidence of any epidemic. All the dead seals were counted between August 6th and August 14th, or as soon as conditions would allow, and there were found 28 adult males, 131 females and 11,045 young, over 10,000 of these latter having been killed by trampling. The old bulls are killed in combat and the females by being pulled about in the struggles for their possession which take place among the bulls. The vast majority of young are killed so early in the season that by the time it is possible to enter the breeding ground they are in an advanced stage of decomposition.

In October the dead seals were again counted, and 14,343 were found starved to death, and 1,546 more in a perishing condition, all this being directly due to the killing of females at sea.

In regard to pelagic sealing, and the effects of the award of the Paris Tribunal, the conclusions are emphatically expressed, and, while there has never been any doubt on these points in the minds of those who have given them the least unprejudiced attention, it is to be hoped that some impression may be made even on prejudiced minds. The closed zone of 60 miles about the islands affords little real protection, save against raids, since the majority of seals feed at a distance of 75 to 150 miles from the Pribilofs, and all that the sealers need do is to lie just outside the 60-mile limit and there await the coming of the seals. The selection of August as an open month is about the worst that could be made, as during that month the weather is the finest of the year and the most seals are going to and coming from the feeding grounds. The majority of seals taken at sea are females, and nursing females at that, all reports that the numbers of sexes are even approximately equal being intentionally or unintentionally false.

The nursing females are obliged to go to sea in search of food at times when the males are safe on shore or in the vicinity of the islands, and, as they are not allowed to leave their harems until impregnated, the killing of each nursing seal means the death of her pup, as well as the loss of that which would have been born during the succeeding season.

It is evident that pelagic sealing and the seal herd cannot exist together; the continuation of the one means the practical extermination of the other, and nothing short of the total cessation of pelagic sealing will enable the seals to recuperate. The closure of Bering Sea might possibly preserve the seals in their present reduced condition, but this is by no means certain, as they are exposed to capture all the way from San Francisco to the Aleutian Islands during six months of the year, and, so long as pelagic sealing is permitted at all, the fur-seal question cannot be considered as settled.

PROPOSED EXPLORATIONS ON THE COASTS OF THE NORTH PACIFIC OCEAN.

THE American Museum of Natural History is about to undertake a systematic exploration of the peoples inhabiting the coasts of the North Pacific Ocean between the Amoor River in Asia and Columbia River in America. The funds for this important undertaking have been very generously

provided by Mr. Morris K. Jesup, President of the Museum, who has done so much already for the advancement of science and for furthering the work of the American Museum of Natural History. In 1895 he fitted out the Peary Relief Expedition, which extended the needed assistance to Lieut. Peary and thus resulted in important advances in our knowledge of northern Greenland and in valuable additions to the Museum. He also contributed the means for the Jesup Collection of North American woods, which is the best existing collection of North American foresty.

The explorations on the coasts of the North Pacific Ocean are intended to cover a period of six years, during which time the investigations are to be carried on in both Asia and America.

There are few problems that are of greater importance to our knowledge of the early history of the American race than its relations to the races of the Old World. The discussion of this problem has been going on for a long period, but its study has never been taken up in a systematic manner. While some investigators maintain that American culture has grown up spontaneously, others claim to recognize traces of Asiatic culture in America. Two ways of connection between the New World and the Old have been suggested: the one leading over the islands of the Pacific Ocean to South America; the other leading along the coasts of the North Pacific coast to our continent. The problem that it is proposed to take up relates to the northern area. In recent time F. Ratzel, Otis T. Mason and Franz Boas have published studies which favor the theory that an early exchange of cultural achievements took place between northeastern Asia and western America, but it cannot be said that this opinion has been established beyond doubt. It is combated notably by D. G. Brinton.

Still more doubtful is the racial relationship between the peoples of Asia and America, and when Boas expressed the opinion that the peoples of British Columbia are more closely related to the Asiatic race than any other North American Indians he did not bring forward any material from the Asiatic side to sustain his assertion. The final solution of these questions requires a systematic study of the whole area. Anthropologists will appreciate the generosity of Mr. Jesup, who makes it possible to investigate this important problem energetically before the destructive influences of civilization have destroyed the primitive cultures entirely.

Our knowledge of the ethnology of the Pacific coast of Siberia is largely based upon the reports of early travelers. Steller's description of Kamchatka supplies a gap that cannot be filled to-day. The circumnavigations of the globe of the last century and of the beginning of this century have furnished us with fragmentary material from these regions, but the only contribution that can claim any great scientific value is that of Schrenck on the peoples of the Amoor. Notwithstanding this work, and the publications of Middendorf, Castrén, Schiefner and Radloff, the types of man, the languages, customs and mythologies of the whole region are practically unknown.

On the American side our information is somewhat fuller. From southern Alaska and the Aleutian Islands we have the linguistic works of Vemiaminoff, the great Russian missionary; of Dall, Pinart, Krause and Emmons. From Arctic Alaska we have mainly the work of Murdoch on the Eskimo of Point Barrow. Investigations in British Columbia have been carried on for a number of years under the auspices of the British Association for the Advancement of Science, mainly by Boas, but much remains to be done.

Work on the Pacific coast of America will be commenced this spring in fields that

have heretofore remained unexplored, and will be continued as long as important gaps in our knowledge of the ethnology of the coast remain to be filled.

The regions in which investigations are to be carried on offer many peculiar difficulties, as well on account of the severity of the climate in the northern portions of the district as on account of the multitude of tribes that inhabit these regions. While almost the whole of Siberia is inhabited by tribes akin in language and similar in type, the eastern coast is occupied by a variety of races. The same is true in America, where in the interior we find a vast sweep of country inhabited by one people, while the diversity of languages and races on the coast is almost incredible. A thorough study of all the innumerable dialects, of the customs of all the tribes and of the physical characteristics, will be required to bring order into this chaos.

The difficulties of this problem will be better appreciated when it is stated that between Columbia River and Behring Strait ten languages are found that are fundamentally distinct, and that these languages have 37 dialects which are mutually unintelligible. On the Asiatic side there are seven distinct languages spoken in at least ten dialects which are mutually unintelligible, but there may be more since our knowledge of the whole area is very meagre.

The problem of the relationship of the racial types is a very attractive one. The relations of the races of southern Alaska and British Columbia to the other North American Indians, although not quite clear, are certainly very intimate, since a gradual transition of the northwest-coast types to those of eastern North America can be established. On the other hand, their features show a decided resemblance with the Asiatic types, but the races which we find in northern Alaska are much more remote from Asiatic types than those further south. It is, therefore, likely that extensive migrations have taken place in this whole area.

We know that great changes in the seats of population have occurred in the central parts of northern Siberia. The weaker peoples of southern regions were pushed northward and finally came to occupy the inhospitable shore of the Arctic Ocean. It will require long and patient study of the inhabitants and of the prehistoric remains of the whole region to unravel its ancient history.

Even after the time of the early migrations of races in this region there has always been opportunity for intercourse and for exchange of inventions and of other ideas. The forms of certain utensils are much alike on both coasts, thus favoring the theory that they has spread over the whole area from one center, but archæological investigation must show how long these forms have been in use and if they were preceded by other forms of culture. The mythologies must be scanned with great care. There is no doubt that among the people of Siberia a constant interchange of tales and myths has taken place. There are indications that the current flowed across to our continent, and it will be the task of the proposed investigation to discover to what extent American and Asiatic ideas influenced each other.

The whole field of research is a vast one, and it is to be expected that the enterprise inaugurated by Mr. Jesup will lead to results which will clear up many of the obscure points regarding the early history of the American race.

THE NEW YORK STATE SCIENCE TEACHERS' ASSOCIATION.

THIS Association, which was organized last July in connection with the Buffalo meeting of the National Educational Association, held its first annual meeting in Syracuse, December 29th–31st, following the

holiday conference of the Academic Principals of New York State.

Tuesday evening, December 29th, President J. G. Schurman, of Cornell University, addressed a joint meeting of the three educational bodies convened in Syracuse; his subject was 'College entrance requirements and the High School curriculum.' President Schurman expressed a strong disposition to encourage more thorough science work in our high schools by accepting sciences in preparation for college, and outlined several preparatory courses in which science should form an important part.

The meeting of the Association opened on Wednesday afternoon with the following paper by the President, Professor Simon H. Gage, of Cornell University:

The Purpose of the New York State Science Teachers' Association and the Work it Hopes to Accomplish.

It is a source of congratulation that the Science Teachers of the Empire State are no longer to remain scattered and unorganized, but by association are to gain the encouragement and enthusiasm which united effort brings. That enthusiasm and efficiency are promoted by such organizations of science teachers is abundantly attested by the results gained through the efforts of the American Society of Naturalists, and the teachers of Illinois, Colorado, California, and of other sections.

An association like this makes it easier for the college and for the secondary school teacher to come together and talk over matters of mutual interest and concern. In these friendly consultations and discussions there will be a chance of finding out something of what is most desirable and what is practicable and possible in the schools each represents. And in these discussions it will not be possible to forget the children in the elementary schools, the great majority of whom come neither under the training of the high school nor of the college, but must be content to get the best they can from the elementary schools to equip them for the struggle of life which stands so near them. What help have these a right to ask from the high school and the college? And then the great world of thought and action whose mighty stream, sooner or later, draws all into it, what does it demand? It is, after all, the final court which tries all alike, and puts each to the test whether he be a college graduate, high school graduate, pupil of an elementary school or one who has only his hereditary endowment of mother wit.

The signs of the times all indicate that the high school teacher is to be at least a college graduate, and the elementary school teacher a high-school graduate. If this is true, while the college has but few under its immediate instruction it determines the character of the high school, and in turn the high school determines the character of the elementary school. The college is then the intellectual guide of the land. Is it and has it always been a wise and sympathetic guide?

If we compare our times with those of 500 or even 100 years ago there will be found an immense difference, and science is largely responsible for this difference. Whether we approve or not, things are not as they once were; whether we designate the change as one of progress or decline, there has been change, the world is not what it once was. The modern citizen must adapt himself to these changes or be ground to powder in the struggle for existence or for preëminence. The professional man, if he is a physician, is a criminal if he does not know and apply the science bearing upon his profession; and the lawyer who has only the knowledge that the Middle Ages might have given him is soon eliminated from the race. It is with hesitation that I speak of the clergyman, but if he misrepresents na-

ture which he might know, and to which he so often reverts for illustration, how can he expect unhesitating acceptance of his words concerning the profound mysteries that all, even the most favored, must 'now see as through a glass darkly'? The artisan, farmer and business man cannot live as did their forefathers; and so from the professions, from all the people, there comes an appeal so earnest, so pressing, that we cannot choose but hear. If they suffer for lack of knowledge we must do our best to supply the knowledge. In place of lofty isolation, or worse, of indifference, we should give them the science we possess, show them the way it is gained, and how much there is yet to be gained, and thus make every boy and girl, and through them every man and woman, in our great State an observer or original investigator in science. This can come about only when real science is taught and studied, only when the fog of opinion and baseless authority are brushed aside and the pupils in the schools are brought in direct contact with nature, and there learn to appreciate and apply the scientific method so admirably stated by St. Paul: "Prove all things, hold fast that which is good."

Our Association ought not and cannot stop with the work of the high school. From the elementary schools most pupils must enter the labors of life; they make the bulk of the State, and a noble patriotism should lead us to do all we can for them. On the principle of self-preservation also such help is wise, for the work of high school and college alike have their foundations laid in the elementary school. As the college reaches down to help and encourage the high school, so should the high school reach down and help and encourage the elementary school, and thus will it come about that every child in the State will be brought into direct contact with nature, where he can experience for himself her inspiring and uplifting sympathy.

If this program is to be carried out the college must train its students and prepare them to take the true science, science at first hand into the high school, and banish therefrom anything savoring of sham. Then the college must honor its graduates by accepting for entrance the work in science of the high school on equal terms with other subjects taught by its graduates. To bring this about, I take it, is one of the duties of this Association. Thanks to the work of the American Society of Naturalists, and to the many able men and women who have worked for the same end, science work done in the high school is at the present moment recognized by a considerable number of colleges. See SCIENCE, December 25, 1896.

It is discouraging, almost prohibitive, for the college to say to the secondary school, when you reach the proper degree of excellence in your science work, the college will consider your appeal for recognition. Why cannot the college state fairly and explicitly exactly what the standard of excellence should be? and with equal fairness and justice say, when your students reach this standard we will accept them for entrance on the same terms as for other good preparatory work. No true friend of science would ask the college to admit students with a training in science inferior to that required in the older disciplines. Let the college make its standard as high as it will, but let it recognize the work that comes up to its standard, and thereby honor its own graduates who have so worthily brought the work of their pupils up to the high standard. Such recognition would put science on a fair footing with the other disciplines. It would encourage and inspire the teacher in the secondary schools and help to give his work a dignity and importance in the eyes of his pupils and colleagues which it can never have if it is not honored by the college. Men still respect and honor

what the college approves, and it is a part of our work to see to it that the college puts the seal of its approval on sound learning in science as well as on that of the other disciplines which it accepts for entrance to its halls.

It seems to me the way before us is clear. Changed conditions have brought new needs, needs that knowledge of science can alone supply. We should do our best to help our day and generation, and in giving it the help of science and the sympathy of nature I feel confident that we are doing right in every way. Science, taught as every true teacher will teach it, will help the students to gain an insight into nature, will bring them face to face with reality, with law and order, and certainly will form at least one element in a noble education. It will emphasize the old lesson that power over nature comes only by obedience to her, and by this obedience, which can come only through understanding, discipline is gained. By action in accordance with law which is understood, and by reflection comes culture. With this discipline and culture come large sympathies and a wide outlook upon the universe. There comes also the consciousness that, while the current of life and law is irresistible, man is a part of the mighty current and his will has its due share in directing it.

Professor Albert L. Arey, of Rochester Free Academy, introduced the topic of the afternoon in the following address:

The Educational Value of the Physical Sciences.

It needs no skilled observer of the recent progress in educational affairs to discover that we are rapidly approaching that utopian condition in which the system of education shall be a system in fact as well as in name, and in which the work of the secondary school shall end where the college work begins, or, if you prefer the idea in this form, in which every subject that is entitled to a place in the secondary school shall be required for admission to some course in college.

As teachers of the sciences it is our duty to accelerate the progress towards this end by all means in our power and to retard it neither by strife among ourselves because of conflicting opinions nor by inaction because of no opinion; but rather, by studying the problems confronting us in the same judicial spirit with which we study those of nature, to seek out the truth, and by discussion of our observations and conclusions to speedily settle mooted questions among ourselves. Among these unsettled questions which we may profitably discuss is this: Which science shall be required for admission to college, if but one is required?

My own answer to this question would be, Physics; first, because of its fundamental character. Bacon long ago said that physics was the mother of sciences. The laws and facts of physics are necessary to the understanding of all other sciences; chemistry is becoming more and more a study of the transformations of energy, and the biologic group is tending in the same direction, while in geology a knowledge of physics is more necessary than in either of those mentioned. Without its aid the action of the grand forces which have moulded the earth cannot be comprehended. And, second, its cultural and informative values are at least equal to those of the other sciences. The logical order in mind-building, as in house-building, is to begin at the bottom, and therefore physics should be required for admission to college if but one science is required. I am aware that several societies of schoolmasters have discussed this question, and that in some cases they have reached the conclusion that some other science should be first. And I hardly expect my friends, the biologists, to agree with me, but friendly discussion leads to progress, and I hope that we

all desire to know the truth more than we desire the triumph of our own convictions.

Other unsettled questions relate to the methods of instruction to be employed in the several branches of science, and these are important.

The methods of teaching the languages and mathematics have been refined by accumulated experience and they are substantially uniform throughout the world, while the teaching of science is of comparatively recent introduction and the variety of methods employed is great; under these conditions uniformity of results in older subjects and great variety in science is what should be expected, and, other things being equal, it is what is obtained.

It behooves us then to accumulate our experience that we may determine upon and adopt *our* best method. The 'Committee of Ten' performed a valuable service in giving us the outlines of a method of teaching physics and chemistry, and most teachers endorse their recommendation, "that these subjects be taught by a combination of laboratory work, text-book and thorough didactic instruction carried on conjointly, and that at least one-half of the time devoted to these subjects be given to laboratory work;" but these directions are not explicit enough to prevent the teacher from doing poor work, even though he follows the suggestions to the letter, and we may profitably consider the objects and the possibilities of the subjects from an educational standpoint.

Properly taught, both physics and chemistry yield splendid mental growth; they lead to valuable lessons of law and order; their facts are important and useful, and they furnish a kind of manual training of a high order of merit. Without desiring to belittle the other possibilities, I shall confine myself to the discussion of the mental growth which may be derived from these subjects, for this is the true education, the culture which remains to the student when the facts of the subject have long been forgotten. Although the cultural value of the sciences was not at once admitted when first claimed, and although we as teachers sometimes lose sight of this point, it is an easy matter to show, as Spencer has done in the first chapter of his 'Education,' that the mental growth which results from the proper pursuit of the sciences is beyond compare the best.

Furthermore, the amount of culture which may be derived from scientific subjects is not limited, as is that which may be obtained from other subjects. The longer one studies a language, the more expert he becomes in the application of the accidental rules of its grammar, and correspondingly less exertion is required for the solution of the somewhat similar problems in construction; but in science, while he becomes more expert in the application of the necessary truths which he assimilates as time goes on, he attacks more and more profound problems, and the mental activity increases; and he can never reach the end, for there are problems in nature which can only be comprehended by the perfect mind of the Creator. As Huxley says, we reach the summit of the mountain we have set ourselves to climb, only to find that it is but a spur of the greater range beyond. And now let us consider *what* faculties of the mind may be developed by the study of physics and chemistry, and how they may be best developed. Remembering that the mind is stimulated to activity in certain directions by frequent exercise in these directions, just as skill in following a trail was developed in the Indian, our question becomes: What opportunities do these subjects afford for the exercise of the mental powers?

Concerning the evolution of the ability to remember, little need be said. This power may be cultivated by the text-book and reci-

tation method, without experiments, without laboratory work, without apparatus, often without even understanding, but what a worthless reward is received for the effort. Our pupils come to the secondary schools with memories so abnormally developed that they have atrophied the interest in nature which each of them inherited, and have made serious inroads upon their reasoning powers.

Perception is rapidly and easily developed by laboratory work. It is the universal testimony of those who have conducted laboratory classes that the students learn to observe accurately and well, but this faculty is not necessarily exercised by either the recitation or the lecture method.

Faraday said: "Society, speaking generally, is not only ignorant as respects education of the judgment, but is ignorant of its ignorance;" and the cause to which he ascribes this state is want of scientific culture.

Herbert Spencer, in his 'Education,' says: "Every step in a scientific investigation is submitted to his (the student's) judgment. And the trust in his own powers thus produced is further increased by the constancy with which nature justifies his conclusions when they are correctly drawn." And he adds: "From all this flows that independence which is a most valuable element in character;" and Professor Bessey, in an address on 'Science and Culture,' delivered in Buffalo last July, says: "The proper pursuit of science should develop a judicial state of mind toward all problems."

Here is abundant evidence that the judgment may be cultivated by proper work in science, and that the student may acquire confidence in his own judgment; but this also can only be accomplished in the laboratory.

The cultivation of the imagination is another of the possibilities. Professor Carhart, in his address to the Science Department of the National Educational Association, says: "It is no new thought that scientific study makes a draft upon the imagination." And this may be best accomplished in the laboratory, although in the hands of a skillful teacher lesser but valuable results may be obtained in the class room.

The class-room work may be, and generally is, so conducted as to afford training in deductive reasoning, such as is derived from courses in mathematics. The solution of problems in physics affords particularly valuable exercise of the mind in this direction if the problems are judiciously selected, but there is a great difference in the benefits derived from the different problems; for instance, to solve such problems as the following requires very little mental friction: "What is the pressure on the upper surface of a Saratoga trunk, 2 by 3 feet?" while the solution of the following problem will compel thought which yields valuable results: "An empty toy balloon weighs 5 g. when filled with 10 l. of hydrogen; what load can it lift?"

The repeated solution of problems based upon the same formula is not to be commended, since the operation soon becomes mechanical, and therefore of slight cultural value, but the skillful teacher can easily introduce some new point into each problem, if he keeps in mind the object of his work. Furthermore, the discussions of the class room may be so shaped as to afford practice in deductive reasoning; the application of theory to the objects of everyday life, the illustrations of the laws, principles and definitions, and questions like 'Account for the slowness with which ice increases in thickness over a pond,' are easily presented to the pupil so as to develop power in this line. The prevailing tendency is, I think, to spend too much time on this class of work, for this is the particular province of mathematics, and deductive reasoning is of less value than

inductive reasoning, because it leads to no higher intellectual level than that of the major premise. Every conclusion and every thought is subordinate to that with which we begin the process, while inductive reasoning proceeds to broader and grander facts, which tax the human mind more and more in the effort to comprehend them.

Now, let us consider in what manner we may develop power to reason inductively. In the lecture room the teacher may lead his class step by step through an inductive process, and he may receive evidence that they have followed him in answer to such questions as, "Why do you believe that magnetism is a molecular phenomenon?" or "Why do you believe that a body in motion will continue in motion indefinitely, unless acted upon by some external force?" But discipline in inductive reasoning is best obtained in the laboratory. It is not derived from such experiments as determining the coefficient of expansion of iron or measuring the resistance of a coil of wire. This class of work is similar to the work that a mechanic does in sharpening and repairing his tools. It may furnish useful manual training, but no such discipline as does the measuring the resistance of many coils of wire so selected as to furnish a line of argument confirming the laws of resistance. Neither do such exercises as the last possess any such value as do original researches; here the experimental method reaches its maximum value.

We thus see that laboratory work is necessary to the best development of the pupil's mind, and that the object of the laboratory course is not to discover laws and facts; not to prove that the book tells the truth; not the manual training involved; but its great advantage over other means of developing the mind.

We see also that class-room work may be made valuable and that it is necessary, because of the culture derived by the students, and because of the opportunity which the teacher is afforded of guiding the students' mental processes, and this combination of laboratory and class-room work is the plan recommended by the 'Committee of Ten.' Let us call it the American method for the present.

If I catch the spirit of the method of instruction in science employed in the schools of Germany, it is expressed in one word—'Questions'—questions which lead the students step by step through their own thoughts to the facts and laws of the sciences. I am unwilling to admit that in the products of corresponding schools the German is superior to the American; but I believe that we may with profit combine the two phases, and that increased educational value will be found in experiments which are performed with a set of questions to be answered before the pupil. Not such questions as "What color is this gas?" but questions so shaped as to compel thinking and to guide the thoughts of the student. In many experimental sciences the directions for experiments are accompanied by questions, but most of them are intended to call attention to facts. What I insist upon is that the teacher have in mind the mental process to which the question will lead the student. In closing, let me say that I found the Regent's syllabus in physics altogether too long for this class of work, and I believe that many teachers who are ready to do this higher grade of work are now rushing through the long course, developing only the memory.

Last November, in his opening address as President of Section A of the British Association, Professor J. J. Thompson says: "I hope I may not be considered ungrateful if I express the opinion that, in the zeal and energy which is now spent in the teaching of physics in schools, there may lurk a temptation to make pupils cover too much ground. It is, indeed, not uncommon to

find boys of seventeen or eighteen who have compassed almost the whole range of physical subjects. Physics can be so taught as to be a subject of the greatest possible educational value, but when it is so, it is not so much because the student acquires a knowledge of a number of interesting facts as by the mental training which the study affords in, as Maxwell says, 'bringing our theoretical knowledge to bear on the objects, and the objects on our theoretical knowledge.'

"I think this training can be got better by going very slowly through such a subject as mechanics, making students try innumerable experiments of the simplest kind, rather than by attempting to cover the whole range of mechanics, light, heat, sound, electricity and magnetism." And he concludes by saying: "I confess I regret the presence, in examinations intended for school boys, of many of these subjects."

Discussion by Professor E. L. Nichols on the Teaching of Physics and Chemistry in the Secondary Schools.

One of the chief difficulties with which we have to cope in considering the subject of science teaching in the schools lies in the fact that the schools have to handle two distinct classes of pupils: The large class which is not going to college and for which the education in science received in the schools is all that they are to receive, and a much smaller class with which the science taught in the schools is preparatory to the further study of science in the college and the university.

It is most unfortunate that our high schools and academies are obliged to treat these two classes of pupils together instead of offering them entirely distinct courses of study. If physics and chemistry, for example, are to be accepted by the universities as entrance subjects alternative with mathematics they must be so taught as to have a disciplinary value in some degree comparable to mathematics. Now, the disciplinary value of mathematics is universally conceded to be exceedingly high.

It is unquestionably possible to teach science in such a manner as to afford excellent mental discipline, but in order to do so the teacher must be thoroughly up in his subject and he must have this continually in view as the prime object of the instruction which he is giving. For the larger class of pupils, on the other hand, to whom the courses in physics and chemistry offered by the schools are all that they are to receive, the object for which the teacher must strive is in great part to convey useful information. In a word, the two objects sought cannot well be united in a single course.

In spite of the fact that nearly all the principals and superintendents of schools with whom I have spoken upon this subject have held it to be impracticable to separate the pupils who are preparing for college from those whom the high school or academy is to afford the completion of their education, I feel compelled to lay down as a first principle that a thoroughly satisfactory substitute for the advanced mathematics now required for entrance to college can only be obtained by teaching science to those preparing for college in an entirely different manner, and indeed in different classes from those who are not preparing for the entrance examinations. Where no such division can be made it is at least possible to treat the science *primarily* with a view to its *disciplinary* or *truly educational* value.

It is scarcely necessary to say that all sciences are to be treated as laboratory subjects. No school course in physics or chemistry which consists in the reading of a text-book, together with recitations upon the same, can possibly afford a suitable preparatory course for college. Neither will such a course prove of any appreci-

able advantage to the class of non-college going pupils. It were in my opinion far better to exclude science teaching from the schools altogether than to teach it in this way. The plan very generally followed in our schools of accompanying recitations upon such a text as indicated above by demonstrations with apparatus performed by the teacher does not call for so sweeping a condemnation; yet let me say plainly that no such course can be regarded as an adequate entrance requirement.

In both physics and chemistry, laboratory instruction is to be regarded as the essential thing; this is to be accompanied, in so far as time may permit, by the reading of a text-book and by demonstrations on the part of the teacher. Since the time allotted to these subjects is rarely large enough to make it practicable to use two books—a text-book and a laboratory manual—the text-book selected should be one written with a view to the teaching of the subject by laboratory methods. It should combine the features of the laboratory manual and the ordinary text-book of physics in brief and clear form. With a good book of this kind the teacher who understands his subject will select certain experiments to be performed by each member of the class individually; others he will reserve for demonstrations to be performed by himself in the presence of the class. The principles illustrated by these experiments, which should be so selected as to demonstrate the laws of the science, should form the subject matter of recitations. The lower the grade of the pupils the more prominent should the laboratory features of the course be made.

I am aware that in our larger schools there are considerable difficulties in carrying out a program such as I have outlined. The chief difficulty is not one, however, which is confined to the teaching of science; the fact is, that in all subjects the number of teachers is entirely too small in proportion to the size of the classes. The difference between the teaching of science and the teaching of other subjects is that in science teaching the attempt to cut down the teaching force, as is done in other subjects, leads inevitably to a complete failure. Such failure brings about too frequently the abandoning of proper science methods even where the teachers themselves are sufficiently well prepared in their subject to know what these methods are. If our school boards and superintendents and principles and teachers were equally honest in the teaching of other subjects they would feel compelled to abandon the teaching of these likewise. The increase in the teaching force demanded for the purpose of permitting the schools to offer satisfactory entrance requirement courses, therefore, is not an exorbitant demand; it is simply a demand which should be met in every department of school instruction. If the question of science teaching in the schools serves to bring this matter more forcibly than it has ever been brought to the attention of those whose duty it is to determine the teaching force in our schools a good work will have been done.

While first-rate work in laboratory teaching of science can not be done where the number of students to be handled by each teacher is very large, something may be done. It is, for example, better to have laboratory experiments carried on by the instructor in the presence of the class than not at all It is much better to have laboratory experiments carried on by groups of students than by the instructor himself. The efficiency of the teaching increases as the size of these groups is diminished, and it reaches its maximum only when the groups are reduced to one or two, or at most three, individuals.

Laboratory practice for the schools is intended to serve a double purpose. In the

first place, to teach the pupil to observe; in the second place, to give him practice in the simpler methods of measurement. It may be laid down as a general rule that quantitative methods should be employed wherever practicable, and that experiments in which a precise and definite result is reached are always to be selected. The metric system should be introduced at the very beginning and should be used *to the exclusion of all others* throughout the course. The introduction of the metric system of weights and measures into practical life in this country, for which strenuous efforts are now being made in many quarters, can be brought about more rapidly by its use in the schools than in any other way. The only thing which interferes with its immediate adoption by the people lies in their unfamiliarity with it. It may be confidently expected that within a few years this system will be used by our postoffice departments, in pharmacy and in every transaction between the government and the people. The schools, however, by the exclusion of the teaching of other systems in arithmetic and in science, can further the reform more effectively than all other agencies combined.

Finally, let me say a word or two with reference to the laboratory equipment. This in chemistry is not a serious matter. In physics, on the other hand, we find a great variety of opinions. There are those who hold that the best instruction is that which is carried on without the use of instruments; that school children should be taught to construct with spools and bits of string the philosophical apparatus which they are to use. We find, as the other extreme, equipments for demonstration, the price of which would involve the expenditure of tens of thousands of dollars. The proper course lies between these extremes. There are certain standard instruments which should be in the possession of every school laboratory for use in demonstration and in laboratory instruction. These are not excessively expensive nor is the number of such instruments very large. A balance with weights, an air pump of the very simplest form but properly constructed with accessories, a lantern for projection, a clock with pendulum, a metronome, thermometers, an abundant stock of glass tubing and of flasks and beakers, a galvanometer (which may be home-made), a simple resistance box, some lenses and prisms, a set of tuning forks, an organ pipe and a sonometer—these together with scales divided to millimeters, a micrometer gauge and a supply of cross-section paper will enable the properly trained teacher to give a very thorough course in laboratory instruction. Where the number of pupils to be handled is large it will be necessary to duplicate many of these instruments. Before the schools can hope, however, to offer science courses which will be acceptable alternatives for the advanced mathematics of our entrance requirement it will be necessary to have a sufficient number of teachers who are thoroughly trained for scientific work and suitably equipped laboratories. The demand of science as regards the number of teachers is not really greater than that of other branches, but it is more urgent, and the failure which comes from inadequate numbers is more disastrous.

Professor John F. Woodhull, of the Teachers College, New York City, referring to the one-year course in Physics, prescribed by the Regents of this State, explained that it was a compromise between the old twenty-weeks course and a better course which would require two years. It is to be hoped that the course will be further lengthened and made to include more laboratory work.

Dr. T. B. Stowell, of the State Normal School at Potsdam, urged the importance of instruments of precision in the class-

room. The charge that the sciences are not comparable with linguistics in educative value, by virtue of their inaccuracies, is not without foundation. If a student in Latin should be taught that the third personal ending of the verb is *t*, or some letter in that vicinity, the college entrance examination would disclose marvelous results. This is only a fair sample of the lax approximations accepted by the teachers of physics in much of their experimental work. No piece of mechanism is too exact to demonstrate physical law, especially if we are to demand that the colleges accept work in the sciences as equivalent to the languages.

An interesting discussion followed concerning the usefulness of home-made apparatus, both sides of the question being advocated. Dr. C. H. Sharp, of Cornell University, thought a well-equipped workshop should be one of the first essentials of every physical laboratory, and a means of providing many well-constructed pieces of apparatus. It was agreed, however, that the quality of the teacher is of higher moment than the apparatus, the good teacher being always superior to his instrument.

Dr. William Hallock, of Columbia University, stated that the 'new curriculum,' which goes into effect with the beginning of the year 1897–'98, permits the student to offer, instead of Greek, an equivalent in the physical sciences for entrance to Columbia. Hence this desirable step in the advancement of sound education is no longer untaken or uncontemplated in this State.

Speaking as a teacher in college he advocated the early study of physics. Mechanics is particularly well adapted to the training of the young mind to see, to think, and to express itself freely. If the preparatory school can teach the scholar to see, to think and to express his ideas; certainly the instructors in college will be very well satisfied with such a preparation, and will have the work of the further cultivation of science greatly facilitated. As a preparation for college it is not desirable that the student be initiated into the mysteries (?) of the ether and the electro-magnetic theory of light and other similar subjects; these, if ever taught, should be taught in college; recondite theoretical discussions are out of place in an elementary course; higher mathematics is also superfluous. It is possible to give a student a very comprehensive knowledge of even the more abstruse facts of physics without requiring a knowledge of mathematics beyond the rule of three. College professors have all been teaching elementary physics because their students came to them with no knowledge of science, but with a loose way of thinking and writing, which is very hard to correct at that stage of their mental development.

As a general educational course for those who do not go to college, the course in physical science is of undisputed value. Here also the mechanical-physical side is preferable to the chemical side, as being simpler, more easily grasped, and more readily and generally applicable to everyday experience. The necessary apparatus is not extensive, complicated or expensive. The course should include a well-selected series of experiments which should tend to a gradual development of the powers of observation, of thought and of expression, rather than to instructing the student in all the latest and most remarkable discoveries of science. If he has the desire and has once acquired the proper method of seeing and thinking, the student will have little trouble in picking up much more information than can possibly be given to him in any superficial course of cramming. Teach him to see, to think and to speak clearly, and all will be well.

Professor W. C. Peckham, of Adelphi College, urged that the attention of the young pupil should be directed to the phenonena of nature about him; to the

changes he may observe in the seasons, the days and the nights; the changes in the weather, the dews, the fogs and rain, hail, snow, the rainbow and the lightning flash. All these should be the occasion of instruction. He should be taught the laws of the action of any machines in the house, on the farm or in the mills of a neighborhood. In the later years of the grammar school and in the high school, place should be found for experimental physics in the illustration of laws. The demonstration of laws is beyond the power of the pupil of this age. This belongs to the well-equipped student of the University. Measurements adapted to the stage of advancement of the pupil may be made in all parts of such a course, though much that passes for physical-laboratory work is only physical arithmetic or geometry, and should be done in the time devoted to mathematics.

If such a course should be carried out, the student would early begin to observe, reflect upon and endeavor to explain what he sees before him in daily life, to be intelligent with reference to the course and constancy of nature. Everything will not then to him be shrouded in mystery and weighty with omen. Such knowledge acquired in the grammar and high-school years will constitute the surest and best foundation for the course in modern physics, the science of the transformation of energy as taught in the college.

The other speakers of the afternoon were Principal William M. Bennett, of Canandaigua; Principal Henry Pease, of Medina; Professor Irving P. Bishop, of Buffalo; Professor H. J. Schmitz, of Genesee; Professor Morris Loeb, of New York University; Professor G. C. Caldwell, of Cornell; Professor H. C. Coon, of Alfred, and Professor Henry L. Griffis, of New Paltz.

It was evident that on one point the Association is practically unanimous: that of all the sciences which the colleges might require for admission, physics is the one that the preparatory schools are best adapted to handle, and that the student is most in need of. The discussion showed clearly also that, in order to do the work in physics as it should be done, the secondary schools need to devote more time and thought to this work, and in some cases, perhaps, less time and thought to work in the other sciences. The laboratory method is indispensable. Several speakers were in favor of leaving all the work in chemistry to be done in college.

After the discussion, the following resolution, offered by Dr. Hallock, was unanimously adopted: "*Resolved*, That this Association urges Congress to take such action as will bring into use, by the government and by the people, the metric system of weights and measures at as early a date as is practicable."

Franklin W. Barrows,
Secretary.

Buffalo, N. Y.

(*To be continued.*)

CURRENT NOTES ON METEOROLOGY.

BLUE HILL CLOUD OBSERVATIONS.

Clayton's 'Discussion of the Cloud Observations' made at Blue Hill Observatory (Annals Astron. Obs'y Harv. Coll., Vol. XXX., Pt. IV.) is a product of which American science has abundant reason to be proud. It represents the results of years of the most careful work at Blue Hill Observatory on the heights, velocities, movements, formation and classification of clouds, and is, as it stands, the most complete publication on the subject of clouds yet issued in any country. That the observers at Blue Hill were doing some excellent cloud work has been known for some years, and short articles by the meteorologist of the station (Mr. H. H. Clayton), which have appeared from time to time in scientific journals in Europe and in this country, have given evidence that some interesting results were

being derived from this work. We venture to say, however, that very few persons indeed have had any idea of the extent or the value of the deductions which were being drawn from the vast body of material thus collected. No one who looks over this volume of 230 quarto pages can fail to be struck with the thoroughness, the exactness and the eminently scientific quality of the whole work. It is obviously impossible to attempt to discuss the publication in these notes. It is our desire simply to call attention to it and to recommend a careful study of it to all meteorologists. Blue Hill Observatory has certainly given us a piece of work which will be a lasting credit to American science.

SOME CLIMATIC FEATURES OF THE ARID REGIONS.

A PAPER on 'Some Climatic Features of the Arid Regions,' prepared by the Chief of the Weather Bureau for the National Irrigation Congress, whose fifth session was held at Phœnix, December 15–17, 1896, is published by the Weather Bureau. It deals with the general climatic characteristics of the southwestern portion of our country, and lays especial emphasis on the amount of wind movement, with a view to determining to what extent the wind may be used as a motive power in driving the mills to be used for irrigation purposes. Sensible temperatures, which have come into prominence recently, and are now regularly noted on our daily weather maps, come in for some share of attention, and two charts illustrate the average actual and sensible temperatures for summer, and the mean actual and sensible temperatures for July, 8 p. m. These charts show very clearly that it is in the regions of the West and Southwest, where the relative humidity is low, that there is the greatest difference between the sensible, or wet bulb, temperature and that of the dry bulb, while in the East, especially in the Northeast, where the relative humidity is much higher, the temperatures as shown by the wet and dry bulb readings are most nearly the same. It appears that there is an abundance of effective wind on the plains east of the Rocky Mountains in all months of the year, and no special adaptation of the ordinary windmill is necessary. The amount of effective wind decreases with approach to the Rocky Mountains.

CLIMATIC ZONES ON THE ISLAND OF SAKHALIN.

AN interesting fact regarding the relation of the floral zones and meteorological conditions on the island of Sakhalin is noted in *Ciel et Terre* (Jan. 1, 1897). This island, lying off-shore from the eastern coast of Siberia, is surrounded by cold currents and is further exposed to the cold northwest winds from the mainland. At sea-level snow falls in May and lasts till the end of that month, and the coast is very cold. The climate becomes milder with increasing distance from the sea and with increasing altitude, the cold air accumulating on the lowlands near sea-level. In consequence of this distribution of temperature the lowlands have an Arctic flora, while the highlands and the intermediate heights have a temperature and, in some cases, a sub-tropical flora. This is a curious reversal from the ordinary condition of things, which gives more and more boreal vegetation with increasing altitude.

R. DE C. WARD.
HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

STATURE AND WEIGHT.

THESE anthropological elements are discussed in a highly satisfactory manner by Dr. Buschan, of Stettin, editor of the *Centralblatt für Anthropologie*, in the 'Real-Encyclopädie der Gesammten Heilkunde,' now publishing in Berlin.

The shortest tribes are the African pygmies, who stand about 1.30 meters. In America no tribe is mentioned with an average under 1.60. The tallest are undoubtedly American, some (doubtful) Caribs of the Orinoco at 1.84, and the Tehuelche, of Patagonia, at 1.78.

The article on the weight gives abundant information about the relative weight of the brain and other organs.

Both articles contain a very complete bibliography of the recent scientific literature of the subjects.

THE NATIONAL MUSEUM OF COSTA RICA.

Largely owing to the energy of the Director Señor Anastasio Alfaro, the large archæological and ethnographic collection brought together by the government of Costa Rica has now been commodiously installed in a building erected for the purpose at San José de Costa Rica. A photograph of it is reproduced in *La Revista Nueva* for October last.

Few localities on our continent offer better specimens of aboriginal pottery and stone work that are discovered within the area of Costa Rica, as was abundantly illustrated at the Columbian Exposition at Madrid. A beautiful example of a decorated jar is given in the journal of the date mentioned, and also the outlines of a number of others.

In spite of the careful studies of Manuel de Peralta on the ancient tribes of Costa Rica, we still remain ignorant of the language and affinities of the tribe which seems to have left the most abundant remains—the Guetares.

D. G. Brinton.
University of Pennsylvania.

NOTES ON INORGANIC CHEMISTRY.

In the last *Berichte* F. Giesel describes an interesting instance of what are probably solid solutions. A little more than a year ago Goldstein showed that the halid salts of the alkali metals take on a more or less intensive color under the influence of kathode rays. Giesel obtains the same result by heating the salts in closed glass tubes at a very low red heat in sodium or potassium vapor. Bromid and iodid of potassium are colored a beautiful blue, chlorid of potassium or sylvine a dark heliotrope, chlorid of sodium or rock salt yellow or brown. The color is not superficial, as clear crystals of potassium bromid a centimeter cube are uniformly colored. The coloration seems to be due to the solution of the metallic sodium or potassium in the solid salt. It is thought probable by Giesel that the blue coloration of rock salt is due to dissolved sodium. Attempts to color in a similar way clear crystals of fluorspar were not successful.

In continuing his investigations into the occurrence of gold in nature, Professor Liversidge finds the metal in all natural saline deposits. Rock salt and other natural salts contain from one to two grains of gold per ton, while bittern waters and kelps furnished in some cases from fourteen to twenty grains.

Professor Liversidge has also examined the structure of gold nuggets from many different sources, by polishing and etching sections. He finds that all nuggets possess a well-marked crystalline structure and usually contain foreign substances. He suggests that the gold has been slowly deposited from aqueous solution and that the nuggets are more or less rolled masses of gold which have been set free from disintegrated veins.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

RESEARCH AND THE UNIVERSITY.

An editorial note in the February number of the *American Naturalist* has been quoted with approval in several journals. We also reproduce this note, partly in order to give it such

currency as we can, and partly in order to comment upon it:

"While the primary object of the University is instruction, there are several reasons why original research is of more than incidental importance to its prosperity. The mastery of his subject, which is characteristic of the man who advances the knowledge of it, is an essential of a good teacher. The belief in this truth is so general that the teacher who is known as a discoverer will more successfully attract students to his classes than he who is not so known. But, apart from this, the general reputation of a school before the public is more surely affected by the research work that issues from its faculty than the managing bodies of some of them seem willing to admit. As an advertisement, successful original work is incomparable. It serves this purpose in quarters where the detailed work of the university is of necessity unknown. We know how it is with our estimate of institutions of foreign lands; we know them by the work of their professors in original research. We believe that those universities which permit of the production of original work by those of its professors who have proven themselves competent for it are wise above those who do not do so. Those who load such men with teaching, so as to forbid such work, reduce their prosperity. We regret to learn that a tendency to the latter course is increasingly evident in some of our great schools. Who, in the chemical world, does not think the more highly of Harvard on account of the work of a Gibbs; how much better is Brown known through the work of a Packard, and so on? Chicago, Pennsylvania and Cornell profit greatly in various fields by the work turned out by certain members of their faculties. Who does not know Columbia, Princeton and Johns Hopkins as the seat of the labors of men whose names are familiar to every American? Yet, in a few of these institutions the prosperity brought by these very men is becoming the means of choking the vitality of these, their life centers, by the increase of drudgery which it brings. The managers will be wise to preserve for these men sufficient leisure to enable them to advance the frontiers of the known, and thus to obtain juster views of things as they are, and to bring us ever nearer to a comprehension of the great laws whose expressions it is their business to teach to the growing intelligences of the nation. By all means nourish the nuclei of the mental life, which will thus preserve the vitality of the cytoplasm of society and protect them from being smothered by it into stagnation and ultimate crystallization."

WE quite believe that research work advertises a university, and in a more effective manner than athletic contests. But we do not think that research is chiefly useful as an advertisement, nor that instruction is 'the primary object of the university.' Instruction, or better training, is the primary object of the college and professional school. Research is not only the primary object of the university; it is the university itself. Further, we think that this is the view of President Eliot, President Low, President Gilman, Provost Harrison and the other able leaders who are now laying the foundations of our universities. We do not see any tendency 'increasingly evident in some of of our great schools to load men with teaching so as to forbid' original work and 'choke their vitality.' Rather it is only within the past few years that the university, as we understand it, has been developed. A professorship, such as the editor of the *Naturalist* holds at the University of Pennsylvania, would not have been possible twenty years ago. The university professor must indeed learn that he may teach and teach that he may learn. It would, perhaps, be well if he more often gave a small part of his time to carrying the spirit of the university to the lower classes of the college. But research is the university; when both teachers and students are not advancing knowledge and applying it for the welfare of society, or learning how to do these things, they are only part of the university as its *impedimenta*.

SCIENCE IN THE NEWSPAPERS.

THE last number of *Nature* contains a leader traversing an editorial in a recent issue of the London *Times*. That journal is accused of an 'outburst' displaying 'misrepresentations' and 'absolute ignorance.' It is scarcely needful to say that in the question at issue—the desirability of establishing a National Physical Laboratory that will do for Great Britain what the *Reichsanstalt* does for Germany—we entirely agree with *Nature*. But the same number of the *Times* that the editor of *Nature* finds 'painful reading' set the writer of this note to wonder why the English daily press is so superior to our own. Of the four editorial articles in the *Times* of that issue, three were devoted to subjects that might be regarded as belonging to science. The point of view was, doubtless, that

of middle class Toryism, but the questions were discussed in a manner that appealed to an intelligent interest on the part of the readers. When the British Association meets, the address of the President is given in full, not only in the London dailies, but also in the provincial press, and pages are devoted to the sectional meetings. The New York papers contained one short note on the Buffalo meeting of the American Association for the Advancement of Science, and the local press confined its attention to our *enfant terrible*, Section I. The Boston *Transcript* probably gives more space to science than any other American daily and is one of the most respectable of our newspapers, yet it describes to its readers how the soul has been photographed by 'a member of the Paris Academy of Medicine' and how 'Sir' Francis Galton has established communication with the inhabitants of the planet Mars. There are often in the daily papers items of scientific news that should be of interest, but their 'probable error' is about ∞. While some of our newspapers are reverting to the pictograph stage of culture, will not one or two of them omit a few items of local and transient gossip and give a little space to subjects of permanent and universal importance?

GENERAL.

The Berlin Academy of Sciences has made an appropriation of 2,400 Marks to Professor Harnack for the expenses of the preparation of a history of the Academy to be published on the occasion of the two hundredth anniversary of its foundation.

At its last meeting, March 10th, the American Academy of Arts and Sciences elected as foreign honorary members Ludwig Boltzmann, of Vienna; Wilhelm Pfeffer, of Leipzig, and Wilhelm Dörpfeld, of Athens.

Mr. Gaston Darboux, professor of geometry at the University of Paris, has been elected a corresponding member of the Berlin Academy of Sciences.

The Zoological Society of New York has received official notification from the Board of Park Commissioners consenting to allot for a Zoological Park the portion of Bronx Park which the Society desired. The land designated is the southern portion of the park lying between Kingsbridge road and Pelham avenue and extending eastward from the southern boulevard so as to include the Bronx Lake and enclose two hundred and sixty-one acres of land. The largest Zoological Garden of Europe, that of Berlin, is only one-fourth this size.

The Royal Botanic Society of London is considering the establishment of a Botanical Institute for the study and teaching of botany in its gardens. The subject was brought before the Society by Mr. William Martindale at a meeting of the fellows on February 27th, and the plan was favored by all who took part in the discussion.

Sir J. Blundell Maple has given University College, London, £100,000 for the rebuilding of the hospital. Lady Wallace has bequeathed to the British nation the finest private collection of paintings and objects of art in the world, valued at between $5,000,000 and $10,000,000.

M. Violle, of the École normale Supérieure, has been elected in the room of Fizeau, member of the section of physics of the Paris Academy.

Joseph James Sylvester, the great mathematician, Savilian professor of geometry at Oxford, formerly professor at Johns Hopkins University, and in 1841 at the University of Virginia, died at London on March 15th, aged eighty-three years.

The eminent mathematician, Dr. Karl Weierstrass, died at Berlin on Februry 19th, aged eighty-one years.

Professor Henry Drummond, of the Free Church College, Glasgow, died on March 11th, at the age of forty-six years. He had published interesting accounts of his travels in tropical Africa and elsewhere, but was best known for his 'Natural Law in the Spiritual World,' which has been published in many editions and in several languages. Professor Drummond gave the Lowell Lectures in Boston in 1893 which were published under the title 'The Ascent of Man.'

We regret also to record the deaths of M. Georges Ville, the chemist, professor in the Paris Museum of Natural History; of Dr. Timothée Rothen, known for his contributions

to telegraphy; of Dr. Peter D. Keyser, an eminent ophthalmologist of Philadelphia, formerly professor of this subject at the Medical Chirurgical College and surgeon to the Wills Eye Hospital; of Dr. Olaus Dahl, professor of Scandanavian languages in the University of Chicago; and of Mr. Luther H. Tucker, editor of *The Cultivator and Country Gentleman*.

THE late Professor Tilanus founded a gold medal, to be given every five years by the University of Amsterdam for a contribution to medicine or natural science. It was conferred this year for the first time on Dr. Zwaardemaker, of Utrecht, for his work on 'Physiology of Smell.'

THE Paris Faculty of Medicine has awarded the Lacaze Prize of 10,000 francs to Professor Nocard, of Alfort, for his researches on tuberculosis.

PROFESSOR OSCAR LIEBREICH, director of the pharmacological laboratory of Berlin University, has received the officer's cross of the French Légion d'Honneur.

THE following further awards of medals are recorded in *Nature:* The Albert Medal of the Society of Arts to Professor David Edward Hughes, F.R.S., "in recognition of the services he has rendered to arts, manufactures and commerce by his numerous inventions in electricity and magnetism, especially the printing telegraph and the microphone;" and a gold medal of the Société Industrielle du Nord de la France to M. Moissan, in recognition of his scientific investigations. The Royal Academy of Belgium has awarded gold medals, of the value of 600 francs, to Dr. C. De Bruyne, of Ghent, for his essay on the influence of phagocytes in the development of the invertebrata; to M. G. Cesàro, of Trooz (Liège), for his essay on Belgian minerals; to MM. J. F. Heymans and O. Van der Stricht, of Ghent, for their conjoint paper on the peripheric nervous system of *Amphioxus;* and to M. Jean Massart, for his essay on the cicatrisation of plants.

PROFESSOR E. E. BARNARD gave an illustrated lecture at Oxford University on March 1st. Sir Clements Markham will lecture before the London Royal Geographical Society on March 22d, on 'Some Considerations in Polar Explorations.'

PROFESSOR W. LECONTE STEVENS, of the Rensselaer Polytechnic Institute, has written to Professor J. K. Rees, of Columbia University, Secretary of Metrological Society: "For reasons which have been fully set forth orally, I regret that it will not be possible for me to accept the Secretaryship of the Metrological Society. My interest in the objects which the Society is endeavoring to attain is not on this account in the least diminished, and I shall continue to spend such time and exert such influence as I may be able to command in furthering these objects."

THE German government has appropriated 20,000 Marks for the investigation of the foot and mouth disease, and the work has been entrusted to Professor Lœffler, of Greifswald, and Dr. Frosch, of the Koch Institute.

PROFESSOR BENO ERDMANN, of Halle, has been awarded 600 Marks by the Berlin Academy of Sciences for researches in experimental psychology.

THE trustees of Cornell University will build for Professor Harris a naptha launch to be used for the transportation of students studying paleontology. It is expected to use the boat during the summer holidays for field work.

IT is reported in the *Engineering News* that the largest spectroscope in the world has just been completed by John A. Brashear, of Allegheny, Pa., the well-known astronomical instrument maker. It was made for the private research laboratory of Dr. Hans Hauswaldt, of Magdeburg, Germany. The instrument contains a concave diffraction grating with 110,000 lines per inch, made on the famous ruling machine of Professor Henry A. Rowland, of the Johns Hopkins University.

ANOTHER secret method of color photography has been recently exhibited in London, the exhibitor being this time an Englishman, Mr. Bennetto. The pictures are said to show colors very well, but until the nature of the process is explained the matter is scarcely one coming within the range of scientific discussion.

A BILL has been introduced into the Minnesota Legislature providing for the appointment of a State phrenologist, who must examine not less than 2,000 Minnesota heads annually!

The Torrey Botanical Club and the College of Pharmacy of the City of New York offer two summer courses in botany: one on the general morphology of plants by Dr. W. Arthur Bastedo; the other on cryptogamic botany by Dr. Smith Ely Jelliffe. The courses will be given at the College of Pharmacy, beginning March 25th and 26th, respectively, and in connection with them weekly field excursions have been arranged, lasting from April 24th to June 12th.

Four hundred Cossacks have been sent to the Russo-Persian frontier to establish a military cordon for the enforcement of quarantine to prevent the introduction of the plague into Asiatic Russia.

A second international Congress of Sanitation and Hygiene of Railways and Navigation will be held at Brussels during September, 1897. The preceding Congress at Amsterdam was of scientific interest, and the next Congress has the support of the Belgium government. Those wishing to attend the Congress or obtain information regarding it should apply to Dr. J. de Lantsheere, rue de l'Association 56, Brussels.

The Council of the American Geographical Society has adopted the report of a committee consisting of Judge Charles P. Daly, Admiral Gherardi and Mr. Chandler Robbins, endorsing the plan of Lieutenant R. E. Peary, proposing to devote a number of years to complete the exploration of the unknown region between Greenland and the North Pole. The Council recommends that the Society subscribe toward the expense of his next expedition, provided that such subscription is needed, and the full amount to carry out the enterprise is subscribed.

The Geographical Club, now the Geographical Society of Philadelphia, during the month of February, 1896, transferred all its books and exchanges to a large room it had rented for a library. But a few days later the building was entirely destroyed by fire, and the Club lost all its possessions. It has only now been possible to make a fresh start, and all the books and exchanges which have been received since the fire and have been stored away have been transferred to the new rooms at 1520 Chestnut street. The Society would be glad to receive publications bearing upon geography.

Nature reports that Dr. Arthur Willey, who worked out the later development of Amphioxus when he was a pupil of Professor Ray Lankester at University College, London, has just made a most important discovery. He has succeeded in obtaining the ripe eggs of the Pearly Nautilus, and is now at work on the development of that most interesting animal. Two and a half years ago Dr. Willey gave up a position in Columbia University and accepted the Balfour Studentship of the University of Cambridge, in order to proceed to the coast of New Guinea and neighboring islands in quest of the embryological history of the Pearly Nautilus. He has had great numbers of live nautilus, but, in spite of all efforts, had, till December 5th last, failed to obtain the eggs. Specimens which he was keeping in a large cage, sunk in the sea at a suitable spot in the Loyalty Islands, were found by him on that day to have spawned. Dr. Willey's indomitable perseverance and devotion to his task have thus been at last crowned by success. Dr. Willey has been assisted in his arduous and dangerous enterprise—amongst the savage people of those remote islands—by grants of money from the Government Grant Fund administered by the Royal Society.

Mr. Palmer, the New York Secretary of State, has drawn up a report showing that the total number of convictions in the New York courts was 66,420 in 1896, as compared with 71,480 in 1895 and 68,146 in 1894.

According to the *British Medical Journal* the medical faculty of Montpellier is authorized to accept the important legacy bequeathed to it by the widow of Dr. Bouisson, which is as follows: The Grammont chateau and grounds to be devoted to the creation of a scientific and humanitarian establishment; also the furniture and linen belonging to the chateau; the interest of $60,000 to be applied to defray the expenses of the establishment; a chapel to be built under the supervision of the executors; the interest of $9,000 to be given as a salary to the priest attached to the establishment. All the instruments, and the drawers containing them, likenesses, manuscripts belonging to the late Dr. Bouisson and Dr. Bertrand, the husband and father of Mme. Bouisson, and a marble bust of

Dr. Bertrand, are likewise included in the legacy.

UNIVERSITY AND EDUCATIONAL NEWS.

MRS. E. A. STEVENS, widow of the founder of the Stevens Institute of Technology, has given the Institute land adjacent to it valued at $30,000.

THE Trustees of the University of Pennsylvania have petitioned the Legislature for an appropriation of $1,000,000 in aid of the University, conditional upon the raising of an equal amount by the friends of the institution.

EUREKA COLLEGE, in Illinois, is said to have received in subscriptions $150,000, of which some $20,000 was given by Mr. T. E. Bondurant, of Deland, Ill.

THE annual catalogue of Princeton University shows that the number of students is 1,045, as compared with 1,088 last year. There are 548 students in the academic department, 374 in the school of science, 115 graduate students and eight fellows.

THE following promotions have been made at Cornell University: Louis M. Dennis has been appointed professor of analytical chemistry; Walter F. Willcox, professor of sociology; Henry S. Jacoby, professor of civil engineering; John Henry Barr, professor of machine design, and Joseph E. Trevor, professor of physical chemistry.

CHRISTOPHER W. HALL, professor of geology and mineralogy and Dean of the College of Engineering, Metallurgy and the Mechanic Arts in the University of Minnesota, has been granted a leave of absence for the year beginning next September. Professor Hall has resigned the office of Dean, which will be abolished. A reorganization of the College has been voted; the departments of civil, mechanical and electrical engineering will constitute the College of Engineering and Mechanic Arts; the departments of mining and metallurgy will constitute the Minnesota School of Mines, and the course in chemical engineering will become a course in pure and applied chemistry in the College of Science, Literature and the Arts, for which the degree of B. S. will be given.

A MEETING of the delegates from the institutions named in the report of the Cowper Commission was held on March 25th. Lord Lister, the President of the Royal Society, moved the following resolution: "That this meeting of delegates represents to her majesty's government the great injury caused to the educational interests of the metropolis by the delay in establishing a teaching university for London, and urges upon them the necessity of taking immediate steps for the constitution of a statutory commission for the reconstruction of the University of London on the lines of the recommendations of the Cowper Commission." The motion was seconded by Professor Rücker and carried unanimously. Remarks in support of the resolution were made by Lord Lister, Sir George Young, Sir Henry Roscoe, Rev. Dr. Wace and Lord Reay. The latter said, according to the report in the London *Times*, that it was most disheartening that the delegates should have to meet again. In no other country in Europe would such a company of distinguished men of science and of learning have urged on its government the necessity of founding a teaching university without its at once acceding to their wishes. We in England were being watched from abroad. Foreign nations formed their opinion regarding our advance in civilization by the action of Parliament in reference to the reconstruction of the University of London. The House of Lords had done its duty; last year the bill was passed unanimously. The mischief was done in the other House. The government had appointed a chairman to the proposed commission; its honor and that of the country was engaged in bringing the matter to a successful issue. It was a court of arbitration that was required, a court which would tend as much towards the progress and honor of the country as the recently formed court of arbitration with the United States.

DR. KARL KAISER has been promoted to an associate professorship of physiology in the University of Heidelberg, and Dr. Karl Fütterer to an associate professorship of mineralogy and geology in the Polytechnic Institute at Karlsruhe.

DISCUSSION AND CORRESPONDENCE.

THE FLORIDA SEA-MONSTER.

Since the publication of the brief note in Science, March 5th, I have made additional studies of the specimens received, which confirm the cetacean affinities more definitely. The extreme firmness and toughness of the thick elastic masses of integument show that the structure must have been intended for resistance to blows and to great pressure, and could not have pertained to any part of an animal where mobility is necessary. They are composed of a complex of strong *elastic* connective tissue fibers, like those of cetaceans. There are *no muscular fibers* present in any of the parts sent. This lack of muscular tissue and the resistant nature of the integument are sufficient to show that the creature could not have been a cephalopod, for in that group a highly contractile muscular tissue is essential.

The structure found is closer to that of the integument of the upper part of the head and nose of a sperm whale than to that of any other structure known to me. It is probable, therefore, that the great bag-shaped mass represents nearly the whole upper part of the head of such a creature, detached from the skull.*

A rough area, shown in the latest photographs of the under side of the upturned mass, may indicate the area that was attached to the skull. It may have belonged to a very large example of a common sperm whale, with an abnormally developed and perhaps diseased nose; if not, then it probably pertains to some entirely unknown creature of the same family. It seems hardly probable that any such large cetacean remains to be discovered. The shape of the mass, and especially of the large, round, closed end supposed to represent the nose, is quite unlike the head of the sperm whale, which is truncated high and narrow in front and projects but little beyond the upper jaw. Moreover, nothing corresponding to the blowhole of a sperm whale has been discovered. Some of the photographs show an indentation near the large end on the upper side, but Dr. Webb informed me that it was only a pit or 'sulcus' about two feet long and six inches deep, perhaps due to injury. The internal cavity, so far as made out, seems to be unlike that of the sperm whale. Therefore, the view that it may be from an abnormal or normal sperm whale must be regarded as a supposition or theory that still needs more evidence to support it, but is at present the most plausible.

A. E. Verrill.

New Haven, March 12, 1897.

* This view has been adopted by me in an article now in type for the next number of *The American Journal of Science.*

THE FLORIDA MONSTER.

Professor Verrill would be justified in making a much more emphatic statement (see Science for March 5th) than that the structure of the masses of integument from the 'Florida monster' resembles blubber, and the creature was probably related to the whales. The substance looks like blubber, and smells like blubber and it *is* blubber, nothing more nor less. There would seem to be no better reason for supposing that it was in the form of a 'bag-like structure' than for supposing that stumps of arms were present. The imaginative eye of the average untrained observer can see much more than is visible to anyone else.

F. A. Lucas.

Washington, D. C., March 8, 1897.

GIBBERS.

Observers the world over have reported, in wind-swept places, the occurrence of pebbles having carved and polished surfaces due to the action of the natural sand blast. German geologists first called these pebbles 'Kantegerölle,' from the edges ground on them by intersecting planes of wear. Walther next proposed to call them 'facettengerölle,' because the facets were the essential features, the edges resulting from the development of the planes. But not all sand-blasted pebbles are facetted. Planes and edges are not more common than concave surfaces and pits; or, as Gilbert found in the Wheeler Survey, a vermicular fret-work wear of the rock surface. For these reasons the name 'glyptolith' was proposed by the writer in an account of the pebbles seen in southern New England. (Am. Jour. Sci. XLVII., 1894, pp.

63–71.) At the time there was no English equivalent to German usage.

W. A. Horn, in *The New Illustrated Magazine* (London, March, 1897, pp. 597–605), gives a vivid description of the Eremian or Solitary Desert region of Australia. The surface of this deflated plain is described as strewn with "bare shining stones, having a polished surface, from the sand continually blowing over them. They are locally known as 'gibbers' (hard g.)." Those who have occasion to employ a name for such pebbles now have an extended choice of German and Greek compounds and English gibberish.

J. B. WOODWORTH.

HARVARD UNIVERSITY.

INTERNATIONAL CONGRESS OF MATHEMATICIANS AT ZURICH IN 1897.

"IT is known that the idea of an international congress of mathematicians has been, above all in these latter days, the object of numerous deliberations on the part of scientists interested in its realization. It has appeared to them, by reason of the excellent results obtained in other scientific domains by an international 'entente,' that assuring the execution of this project would have very weighty advantages.

"As the outcome of a very active exchange of views, accord was reached on a prime point. Switzerland, by its central geographic situation, by its traditions and its experience of international congresses, appeared designated to invite a first attempt at a reunion of mathematicians. In consequence Zurich is chosen as the seat of the congress.

"The mathematicians of Zurich do not disguise from themselves the difficulties they will have to surmount. But in the interest of this enterprise they have thought it their duty not to decline the flattering overtures that have been made them from all sides. They have decided, therefore, to take all preparatory measures for the future congress and, to the extent of their powers, to contribute to its success. So, with the concurrence of mathematicians of other nations, was formed the undersigned committee of organization, charged *to bring together, at Zurich in 1897, the mathematicians of the entire world.*

"The congress, in which you are cordially invited to take part, will take place at Zurich the 9th, 10th and 11th of August, 1897, in the halls of the Federal Polytechnic School. The committee will not fail to communicate to you, in time, the text of the program determined, begging you to inform them of your adherence. But even at present it may be said that the scientific contributions and questions of policy will pertain to subjects of general interest or recognized importance.

"Scientific congresses have also this great advantage, to favor and keep up personal relations. The local committee will not fail to give great care to this part of its task, and, with this aim, it will arrange a program of fêtes and social reunions.

"May the hopes reposed in this first congress be fully realized! May numerous participants contribute by their presence to create, among colleagues, not alone coherent scientific relations, but also cordial bonds based on personal acquaintance!

"Finally, may our congress serve the advancement and the progress of the mathematical sciences!"

The invitation of which the above is a translation is signed by eleven from Zurich and ten associates, as committee.

Readers of SCIENCE already know of the persistent efforts of Vasiliev, of Kazan, and Laisant, of Paris, to establish this congress. It is matter for rejoicing that their noble endeavors have been crowned with this definite success.

GEORGE BRUCE HALSTED.

A NEW GEOGRAPHICAL MAGAZINE.

THE appearance of a new geographical magazine * is a matter for both congratulation and regret. The magazine referred to is designed to furnish authentic and well-selected geographical data for the use of school teachers, and the opening number gives promise that much good may be expected from it in this direction. The articles presented seem well adapted to the audience addressed and are scarcely open to

* *The Journal of School Geography.* R. E. Dodge, responsible editor; W. M. Davis, C. W. Hayes, H. B. Kümmel, F. M. McMurry and R. DeC. Ward, associate editors. Published at Lancaster, Pa. Price, $1.00 a year.

criticism, when the special aim of the publication and the space available are considered. It is not so much the subject-matter contained in the new magazine, or the dress in which it appears, however, as the future of the enterprise and the demands of geography in America that suggest remarks.

If the teachers in our schools will support a magazine devoted to the pedagogical phases of geography there is certainly a broad field open to Professor Dodge and his able associates, but unless the new magazine has such financial support as to be practically independent of the returns received from subscribers, one can scarcely expect it to be long-lived. Other geographical magazines have germinated in this country, blossomed for a short period and, for want of financial support, died or passed to a condition of 'innocuous desuetude.' There is nothing in the appearance or character of the new effort to indicate that it possesses greater vitality than its predecessors.

In addition to the geographic magazines referred to, at least six of the geographical societies of the United States are engaged in publishing magazines and journals. None of these publications are widely known or are exerting an important influence on the development of geography. None of them can be said to have a high standard or to make a near approach to what may reasonably be considered as an ideal geographical magazine.

Instead of welcoming an addition to the number of but little known and far from successful publications already existing, with which the *Journal of School Geography* claims a place, it is for many reasons rather to be wished that the number might be materially decreased and the survivors strengthened.

If our several geographical societies could be induced to put aside what are considered local interests and unite in issuing a single, strong, well-edited and attractively-illustrated monthly magazine, in which the proceedings of the several societies could be reported and the best papers read at the local meetings be published, a great gain would certainly result. Such a plan would do away with duplication in the printing of reviews, current notes, etc., and furnish the members of the affiliating societies with a wider range of reading matter, probably with a decrease in expense, than is afforded by the present system of multiple publication. An *American Journal of Geography*, in fact as well as in name, published under the auspices of the geographical societies of America, would be welcome in many libraries where scarcely one of the present publications referred to finds a place. The proposed magazine, being supported directly by several societies, would be furnished to each of their members, thus securing a circulation at the start of at least 4,000. The subscriptions of teachers and those interested in geography, but residing at a distance from the cities where geographical societies exist, would largely increase this number. A section devoted to *studies for teachers* would fill the place claimed for the journal that has just appeared.

The good that such a magazine as here suggested might accomplish by reaching a larger audience, furnishing them with more varied and more carefully selected reading matter, and by maintaining a higher standard than the existing geographical publications in this country, would certainly be far greater than under the present system.

The proposed magazine might be placed under the general management of the presidents or secretaries of the affiliating societies, but the responsibility for its appearance and standing should rest with a paid editor. Possibly, also, compensation should be offered for special articles in order to keep abreast of the times and furnish opportunities to those who could not afford to give their services.

The deleterious results of diffused and frequently antagonistic efforts in publication, are painfully apparent in the low grade of many of our newspapers and popular magazines. This almost inevitable result of multiple publication may be avoided in geography by a union of interests.

ISRAEL C. RUSSELL.

COMPLIMENT OR PLAGIARISM.

Now that Professor Halsted has made use of three issues of SCIENCE to prefer and establish charges of plagiarism against us, it may be well to make a comparison of the charges with the evidence as brought out in the discussion.

In his first article he says: "Without the slightest word of acknowledgment these professors [Beman and Smith] '*took*' a whole block of problems and a long note from Halsted's Elements of Geometry;" or, as he puts it more picturesquely in another place: "[They] have paid Dr. Halsted's Elements of Geometry the startling compliment of appropriating bodily Book IV., Section I., Partition of a Perigon (pp. 151–154), in their Geometry, pp. 179–181; Ginn, 1895. Elementary Geometry has been the most stable part of all science. The introduction into it, by Dr. Halsted, of the section entitled Partition of a Perigon was an utter innovation. The section, and even the very phrase 'Partition of a Perigon' had never before appeared in the world. This being the fact, the following 'deadly parallel' shows a psychologically interesting ethical color-blindness on the part of two teachers not otherwise known to have been openly immoral." Then follows a comparison of the two books, omitting the 'long note,' which seems to have disappeared from the controversy.

We have shown that the *order* of these problems is a perfectly natural one and not original with Professor Halsted. We have shown that the *solutions* of the problems in the two books are not the same. We have shown that Professor Halsted took the word 'perigon,' on which so much stress has been laid, from Sandeman's Pelicotetics without acknowledgment, and yet he affirms that "their [our] * researches on this matter turn out highly complimentary to me [him];" and that "our having reason to believe that W. B. Smith, Newcomb and Faifofer all did see the word for the first time in Halsted's books * * * surely * does me [him] great honor." Evidently "honors are easy."

That Professor Halsted furnished the facts given on page 237 of Cajori's Teaching and History of Mathematics in the United States we are not inclined to deny, but we look in vain for the slightest reference to the word 'perigon' or its origin.

That the phrase 'Partition of a Perigon' occurs only in Halsted's book and our own is true—so far as we know—but surely the notion is not so original that Professor Halsted would claim it as his personal property. Compare Henrici und Treutlein, Lehrbuch der Elementargeometrie, 1881, p. 91: "Denkt man den Vollwinkel [Vollwinkel-perigon] * * in n gleiche Teile geteilt;" and again, "Teilt man den Vollwinkel in n gleiche Teile." If this does not suggest 'Partition of the Perigon,' how would the idea be expressed in German?

In the preparation of our geometry we made considerable use of Henrici und Treutlein and in our preface we mention it first among the helps employed; with respect to the sources of his material it is not the habit of Professor Halsted to take the public into his confidence. How familiar he may have been with this book we do not know.

In answer to his last question we might say that Professor Beman saw Sandeman's Pelicotetics for the first time in the Peabody Institute library at Baltimore in February, 1882, and secured a copy for his private library that same year.

With this summing up of the evidence we cheerfully submit the whole question to the intelligent jury of readers of SCIENCE, feeling absolute confidence as to the verdict that will be rendered.

BEMAN AND SMITH.

[As the charges were first brought by Professor Halsted, it seems best to close the discussion with the reply from Professors Beman and Smith.—ED.].

MEXICAN HIEROGLYPHS.

TO THE EDITOR OF SCIENCE: I have received the following note from Mrs. Zelia Nuttall, an expert in all that pertains to Mexican hieroglyphs, in which she shows that figures 114 and 115 of my paper in United States National Museum Report, 1894, Pp. 623–726, were not, as I supposed they might be, figures of drills. The fire drill in all countries is similar to the drill employed in making holes through hard minerals and wood. Mrs. Nuttall's correction makes it probable that the North American nor the South American either of them know other than the straight shaft.

J. D. MCGUIRE.

Fig. 114 is a copy of the hieroglyph of the town Huitzoco taken from the Codex Mendoza, p. 39, fig. 4. (See text of Codex Mendoza,

Vol. V., Kingsborough.) The fact that it was employed in pictography to express the sound *Huitzoco* proves that the object depicted is a 'Huitzoctli,' described in Nahuatl dictionaries as 'a staff of oak, used as a lever to upturn sod or earth—a digging pole.' The figure placed across the staff is the emblem of the pulque (octli) gods and expresses here the *octli*. It offers another interesting illustration of the employment by Mexican scribes of complementary signs, in order to render the meaning of a hieroglyph unmistakable; a usage I had detected and published about 1886 (see Standard on Headdress? Peabody Museum, Papers, Appendix).

From the foregoing it is evident that, instead of a possible drill, the hieroglyph represents the digging staff, employed for its phonetic sound with a complementary sign determining it, thus: huitzoctli word expressing name *Huitzoco* (octli), complementary.

Fig. 115 is the hieroglyph of the town, Tlachmalacac (see, also, text of Codex Mendoza). This word explains to us that the signs are representations of 1, the *tlachtli*, not 'a possible frame,' but the groundplan of the court employed for the national game of ball, or tlachtli. This sign is well known, and frequent examples of its employment to express the sound *tlach* are to be seen in the same Codex Mendoza; see, for instance, plate 33, fig. 2, and plate 38, fig 1, where the name of the town of *Tlachco* is expressed in picture writing.

See also plate 22, fig. 4 (town *Tlach*yahualco), and plate 47, fig. 3, *Tlach*quianhco, expressed by the sign tlachtli, within which are raindrops—quiachuitl. The affix *co* means *inside of* and is expressed by the rain being represented *inside* of the tlachtli. The object represented on the tlachtli sign is a spinning-wheel, a *malacatl*; it has nothing to do with the *tlachtli* and is only employed to express its own sound.

Figs. 100 and 116 are *both* representations of priests kindling the New Fire at the beginning of a new cycle, a ceremonial observance.

Fig. 116 shows how the *themaitl*, or fire drill of wood, was employed to kindle fire in a log or large piece of prostrate wood; a fact that does not at all contradict Mr. McGuire's interesting observation that, doubtless, the Mexicans employed the same kind of drill for boring wood.

ZELIA NUTTALL.

THE PLAY OF ANIMALS; THE FUR SEAL.

IT was with some little pleasure that I read the review of Professor Gross' *Die Spiele der Thiere* in SCIENCE for February 26th, and found that he holds play in animals 'to be an instinct developed by natural selection, * * and to be on a level exactly with the other instincts which are developed for their utility.' The pleasure lay in the fact that having ventured into the (to me) foreign domain of psychology, I had written as follows: "The great redeeming feature of the fur-seal's character is its playfulness when young, for few animals seem to enjoy life so well as the rollicking pups and young bachelors. But here again it is necessary to curb our imagination and to remember that while the young seals undoubtedly do derive a certain amount of enjoyment from their sports very much of what strikes us as mere play is in reality dawning instinct. The sporting of seal pups foreshadows the time when their very lives will depend on the ability to capture food for themselves, and the playful wrestling contests in which they perpetually engage are mere hints of future fierce battles among bulls. Yearlings do not 'round up' harems of pups with the reasoning care that a child bestows on her dolls, but because centuries of heredity have caused this instinct to be developed long before it serves any practical purpose." As the young seals do not associate with the old, their play would seem to be purely instinctive. The conclusion derived from this study of the mental traits of the fur seal and its direct bearing on the questions at issue is that "this acting by instinct is the keynote of the seal's character; the mind, like the body, has been molded by natural selection acting on the mass, so that one seal behaves like another and knows just as much as another, and no more. It is a creature of instincts and not guided to any great extent by reason; as it has done in the past so it will do in the future; its habits being formed by the slow process of natural selection can change but slowly; hence the fur seal is not likely to alter its habits nor to adapt itself to changes in surrounding conditions."

F. A. LUCAS.

SCIENTIFIC LITERATURE.

Electro-Physiology. By W. BIEDERMANN, Professor in Physiology in Jena. Translated by FRANCES A. WELBY. Macmillan & Co., London and New York. 1896. Vol. I. Pp. 522.

The perusal of such a work rather 'takes it out of one' under the most favorable conditions. With regard to the present treatise, a great deal may be said in praise of the patience with which the material has been collated, and the soundness of the conclusions which have been drawn from experimental facts. Indeed, the scientific independence of the author is evinced in the homogeneity of the work, which is far from being a mere compilation. On the other hand, the intrinsic difficulties of the subject are much increased by the labored style of their presentation; the sentences are frequently huge in length, and the noun substantive is commonly required to be carried in mind through several successive paragraphs. The pedagogic error, so common with investigators, of presuming too much on the ability of the student to read between the lines, is here too constantly illustrated. Another practical defect of the work is the lack of topical subdivisions of its subject-matter, by which device the reader might have been enabled to refer at once to any desired point of the discussion. Also, in a book designed chiefly for the use of investigators, a more complete bibliography of the subject than that which has been given might fairly have been expected. In all these respects the work is far less admirable than that which pertains to the same subject in Hermann's *Handbuch der Physiologie*, published seventeen years ago, and is much inferior in the presentation of its histological sections to the corresponding parts of *Quain's Anatomy*.

The name 'Electro-Physiology,' by which the book is announced, is ill-chosen and by no means denotes its scope, as is evidenced by the following chapter divisions of the subject:

1. Organization and Structure of Muscle, pp. 51.

2. Change of Form in Muscle during Activity, pp. 199.

3. The Electrical Excitation of Muscle, pp. 156.

4. Electro-motive Action in Muscle, pp. 122.

5. Electro-motive Action of Epithelial and Gland Cells, pp. 57.

After giving due weight to these criticisms, it is only fair to say that, since the appearance of Hermann's *Handbuch*, there has been no such approach to providing the student of physiology with a complete exposition of present knowledge of the field covered, as is made by this treatise of Biedermann.

When the reader has become familiar with the intricacies of his style it is clearly seen that the author is master of his subject; he has succeeded to a singular degree in linking his data into a continuous story, which, now and then, is summarized to show what general truths have been gained and whither they lead. It is the opprobrium of our knowledge of nerve-muscle physiology that, though its study has developed a vast number of experimental facts, it is well-nigh impossible to sift those that pertain essentially to the living organism from those of purely instrumental origin. Professor Biedermann, while giving full treatment of the experimental processes lying at the base of his conclusions, has done much towards providing a philosophical exposition of our knowledge. The author is at his best the greater the intrinsic difficulty of the subject he expounds; while, *e. g.*, his description of the comparative histology of muscle lacks much in clearness, his account of the intricate optical changes undergone by the contracting tissue is admirable. The statement, p. 55, that a single muscular twitch is characterized by 'rapid contraction, with much slower subsequent elongation,' is certainly misleading as regards the action of fresh muscle under tension. The so-called 'latent period' of muscular excitement, or the time elapsing between the application of a stimulus and the beginning of muscular shortening, which was first announced by Helmholtz to have the value of about .01 sec., has gradually been reduced by subsequent investigators.

The author's discussion of this subject is one of his best. It is strange, however, that the mechanical factor involved in the latent period is neither here nor in other works more clearly expressed. As the strength of a single stimulus is gradually increased, so as to produce a series

of contractions varying from minimal to maximal in amplitude, the latent period is observed to become progressively shorter. The weaker waves of submaximal contraction do not pass through the full length of the muscle, and the unexcited part of the tissue acts simply as an elastic band whose tension must be increased to a definite degree before visible shortening of the whole muscle can take place. It can readily be seen that the time lost through the extensibility of the uncontracting part of a muscle fibre largely accounts for the 'latent period of stimulation.' The adjective 'Subliminal,' used by the translator to express a stimulus too weak to excite contraction, is not to be found in Webster.

Errors of type and expression in the work are not numerous; but in the figures of tracings representing the effect of rest on the curve of muscular fatigue the increased height in the contractions immediately following an interval of rest is not represented. Also, on page 540, the terms hilus and hilum are used indifferently.

Certain views which are implied, rather than expressed, should not be admitted without specific inquiry. Thus, the author assumes a likeness in kind between those summations of stimuli, each stimulus by itself being ineffective, which, on the one hand, produce tetanus in certain slowly moving muscles, and, on the other, cause reflex action from the spinal cord when applied to a sensory surface (p. 119). It is a satisfaction to find, at last, an author who gives true value to current *density* as a physiological stimulus rather than to current *intensity*; a current of given intensity has very different stimulating powers according as it is led to the tissues through broad or narrow electrodes. To the younger student, the explanation that physiological kathode, or point of excitation by the electric current, is at the place where the current *leaves* the irritable tissue, will clear up many obscure results of experiment. The author draws, perhaps, too close an analogy between the polar excitation effects shown by some protozoa on the passage of a constant current through them and the excitatory phenomena of muscle and nerve. There is nowhere to be found a more complete discussion of du Bois-Reymond's law of the excitation of irritable tissues. The law asserts, in brief, that it is not the absolute intensity of the stimulus which determines its irritating value, but fluctuation in intensity. Biedermann shows that the prolonged contraction manifested by muscle during the passage of a constant current through it forms no true exception to the law. He also calls attention to a needed amendment to du Bois-Reymond's law, in that "not merely the *local* changes at the seat of excitation, but still more the propagation of the excitatory process, *i. e.*, the discharge of a wave of excitation (contraction), are dependent upon the *variations* of current intensity, and the steepness of the same, in the case of tissues in which conductivity is adequately developed. The 'universal law of excitation' refers, therefore, less to the manner of the excitatory process, and effectuation of the changes of the excitable substance fundamental to it, *at the seat of direct excitation* (physiological anode and kathode), than to the conditions of the propagation of the excitatory process by conduction" (p. 314).

It is a disappointment to find that, as yet, there is little light to be shed upon the relations between the excitatory and contraction waves of muscle.

Much abtruse and technical literature would have to be culled in order to reach the results so ably summarized in the sections on electromotive action in muscle; particularly satisfactory are the pages devoted to the 'Positive variation of the muscle current.'

It is a worthy reward for all the thought and labor that for nearly fifty years have been devoted to electro-physiology, to find that here the facts are pointing to a physiological generalization which was first conceived in another field of the science. A decade ago Gaskell, as the result of a masterly series of researches, concluded that to each contractile tissue there were supplied two forms of nerve fibre, a motor and an inhibitory branch, the former exciting to functional activity and the latter bringing the organ to rest. As motor action, representing evolution of energy, is a result of chemical disassimilation, so inhibition is coincident with absorption of energy by a tissue and its chemical change is one of assimilation. This theory, arrived at by a study of the phenomena

of muscular contraction, is now supported by results obtained through the study of the electrical changes set up in muscle by artificial stimulation. In brief, the chemical changes of disassimilation, coincident with functional activity, which are brought about by stimulation of the motor nerve, cause the active part of the tissue to become electro-negative to the resting part.

On the other hand, certain other efferent nerves, having an inhibitory effect, cause, when stimulated, the part of the muscle under their influence to become electro-positive to the resting part. In all probability these nerves also excite chemical assimilation and the absorption of energy.

It is approaching an anti-climax to turn from such a conception as this to the arid field of glandular electricity. Here the mechanical difficulties in the way of experimentation have affected the purity of results to such a degree that little of physiological importance can, as yet, be predicated from the work. In conclusion, a word of admiration is due the translator to whose fortitude we are indebted for this work in its present form. The rendition seems, for the most part, to be excellent; and the bookmaking by Macmillan is, of course, of the best.

HENRY SEWALL.

UNIVERSITY OF DENVER.

The Coming Ice Age. By C. A. M. TABER. Geo. H. Ellis. 1896. Pp. 94.

The difficulty of accounting for the Glacial period is so great and the disagreement of glacialists is so profound that one cannot but welcome any sincere effort to shed additional light upon the subject. Especially is one inclined to give a candid hearing to an experienced navigator who has been led to study the effects of ocean currents upon climatic conditions. Such is the author of this little volume, who, in his extensive voyages had his attention directed to the subject at an early date, and in later years has made his personal observations the basis for collecting a large body of facts otherwise attainable.

The theory of the author is that a land connection between Patagonia and the Antarctic Continent, or a great diminution of the channel between those lands, would produce an effect upon oceanic currents favorable to the glaciation of both hemispheres. In supposing such a land connection he is in company with many zoologists who have inferred the same from the unique distribution of the plants and animals of the southern hemisphere.

Assuming this extension of land from Patagonia to the Antarctic Continent, the effect upon the currents would be, according to the author, as follows: The prevailing westerly winds in the south temperate zone would pile the waters up against the western side, and would drive them away from the eastern side of the southern part of this continent. The shape of the continents and the general direction of ocean currents are such that during this condition of things there would be a movement of water towards the south pole in excess of that moving toward the north pole. This accumulation of water about the south pole would be increased by the attraction of the water until there was a submergence of the isthmus connecting Patagonia with the Antarctic Continent, such as to allow a free passage from the higher levels of the Pacific to the lower levels of the Atlantic in that latitude. This water from the Pacific, being a cold current, would displace that which had formerly been drawn down from the tropics on the east side of South America, and thus lower the temperature of the Antarctic Continent and produce conditions favorable to glaciation, such as exist at the present time. These conditions he believes to be cumulative.

This very general statement of the theory passes over many details, and it may be that it does not in all respects fairly represent the author's views. But we are compelled to confess that his style is so obscure, and his digressions are so frequent, that we have found it difficult to be sure that we have comprehended his meaning. The author's confidence in the stability of the earth's crust is such that he is not willing to grant the moderate changes of level in the sea-bottom south of Patagonia which would be necessary to secure the submergence there which his theory demands; therefore, he is compelled to throw the whole burden upon the winds and the augmenting attraction of the

accumulating water. But it is difficult, not to say impossible, to believe that these forces would be adequate to the production of any such results as he supposes. The total amount of displacement which could result from them could be only a few feet.

Combined with the theory of moderate oscillations in the earth's crust at the proper places, Captain Taber's views are helpful in appreciating the effect of the ocean currents in so distributing heat and moisture as to produce glacial conditions both in the southern and northern hemisphere. But, unless he admits these changes of land level, we see little force in his arguments, and consequently his prognostication of a coming ice age is without any scientific basis.

G. Frederick Wright.

Researches upon the Antiquity of Man in the Delaware Valley and the Eastern United States. By Henry C. Mercer. Ginn & Co., Boston. 1897. 8vo. Illustrated. Pp. 178.

This volume is one of the series in 'philology, literature and archæology' published by the University of Pennsylvania. They are not intended to be 'popular,' but to convey the products of original research work. Such is the character of the present number. It is a plain and careful description of a series of studies conducted in the last few years, with the object of finding out whether there is sufficient evidence in the locality selected to assert that man lived there in the glacial or early post-glacial period.

Such assertions have been and are confidently advanced by several prominent American archæologists, especially with reference to the exhumation of chipped stones from the glacial gravels at and near Trenton, New Jersey.

On this particular point Mr. Mercer's personal researches are negative. His repeated examinations of the Trenton grounds 'failed to reveal a specimen in place' (p. 32); the caves he examined along the Delaware river contained nothing of man's handiwork which pointed elsewhere than to the Indian as we know him; and the so-called 'turtle backs' of argillite, found in the Trenton gravels, were probably 'intruded by modern Indians' (p. 60); and, finally nothing was found 'to corroborate the alleged antiquity of the chipped blades from Trenton,' and not a little to weaken it (p. 85).

These results, though in a measure negative, leave the supporters of the 'glacial man' theory at Trenton, with a large fraction of their argument exploded, since much has been made of the 'argillite implements' as proving antiquity. Now we know that whole quarries of argillite were worked by the modern Indian.

Other essays in the volume describe the exploration of an Indian ossuary on the Choptank River, Maryland, with a description of the physical characters of the bones by Professor Cope, and a discussion of their diseased (probably syphilitic) conditions by Dr. R. H. Harte; investigations by Mr. Mercer in an aboriginal shell heap on York River, Maine, in which traces of cannibalism were discovered; and excavations at the 'Indian house' and at Durham Cave, by the author. Among other interesting facts which Mr. Mercer has been enabled to substantiate by those studies is that in long post-glacial times the peccary, the tapir, the mastodon and the fossil sloth (*Megalonyx*) roamed the forests of the eastern United States. This, however, 'refers to an epoch in the past removed by many milleniums from the discovery of America' (p. 175), in the author's opinion.

The earlier pages of the volume recite several important investigations of the author in the 'quaternary' deposits of France and Spain. These gave him an excellent standard of comparison in his American work and the thoroughly scientific manner in which he carried it out is visible on every page.

There are a number of accurate and well-taken illustrations of localities and specimens, and the notes will aid the student in gaining access to the literature of the subject. It is to be regretted that no index was prepared.

D. G. Brinton.

University of Pennsylvania.

SCIENTIFIC JOURNALS.

PHYSICAL REVIEW, MARCH–APRIL.

The Lead Cell: By B. E. Moore. The extension of the theory of free ions, solution ten-

sion and asmotic pressure to the lead cell was first made by Le Blanc. This theory is farther developed in the article. The number of tetravalent lead ions at the positive plate of a charged lead cell is very small. When a current is taken from the cell, $PbSo_4$ is formed when the point of saturation of bivalent lead ions is reached. If the formation of such a product involves time, a supersaturation of bivalent ions would rapidly follow. This is especially true if the current is large. Upon the Nernst theory this would produce a rapid fall in the electro-motive-force of the cell, until equilibrium is produced, *i. e.*, until the rate of precipitation of the lead sulphate is equal to its rate of formation. In the charging process there would be a corresponding diminution in the products of ionization, and the charging electro-motive-force must rapidly rise above the normal electro-motive-force of the cell. Experiment confirms these deductions from the Nernst theory, and shows that these initial changes take place largely within the first two minutes after closing, or after opening the circuit. Debarring this initial change in the cell, which causes large losses in energy, the curve of the electro-motive-force of the cell is shown to agree through a wide range with changes in electro-motive-force brought about by progressive changes both in the solution tension of the electrode and in the pressure of the ions. It is shown that Planck's thermodynamic treatment leads to the same deductions.

On the Influence of Electrification upon Surface Tension of Water: By E. L. NICHOLS and J. A. CLARK. In this paper an attempt was made to determine by quantitative measurements the change in the surface tension of liquids to which the well-known effect of electrification upon water jets, etc., is due. The method pursued was that of the water dropper. A reservoir from which the water drops proceeded was kept charged by the continuous action of a Holtz machine driven by an electric motor. A large battery of Leyden jars furnished the circuit with sufficient capacity to prevent rapid fluctuations of potential.

The electrification of the reservoir was measured by means of a form of an absolute electrometer; the temperature of the falling drops by means of a thermo-electric junction. The range of potentials was from zero to 11,000 volts. Beyond the latter value measurements became impossible because drops were no longer formed. The result of these measurements indicates that the surface tension falls off at first slowly, and then more and more rapidly as the potential rises, until at 10,000 volts it has been reduced to about one-half its value for the electrified liquid. No difference could be detected between the action of positive and negative charges.

On the Mechanical Conceptions of Electricity and Magnetism: By W. S. FRANKLIN. This paper develops detailed mechanical conceptions of various electro-magnetic phenomena, based upon the fundamental conceptions of Maxwell, with particular reference to the quantitative relations which hold among the various electro-magnetic quantities. Among other things, a minute description is given of the action which takes place in the region surrounding a Hertz oscillator.

On a Possible Development of the Idiostatic Electrometer: By C. BARUS. The idiostatic electrometer has not hitherto been developed to an extent comparable with the quadrant electrometer; yet it possesses the advantage that it introduces no foreign potentials to cooperate with those under investigation. The writer describes certain results obtained in an endeavor to perfect the idiostatic electrometer. The moving system was supported by a double bifilar suspension. The disc was made very light and protected by a guard ring. The excursions of the disk were observed by Michelson's refractometer. Thus in one case ten fringes passed for a single volt; estimating 0.1 fringe the sensitiveness thus became 0.01 volt.

Empirical Formulæ for Viscosity as a Function of Temperature: By A. WILMER DUFF. Several formulæ for the viscosity of liquids at different temperatures have been proposed. The writer classifies and discusses these and considers means of interpolation and extrapolation.

A synchronous Motor for Determining the Frequency of an Alternating Current: By GEORGE S. MOLER. This paper describes an exceed-

ingly neat instrument for determining the frequency of an alternating current. A small synchronous motor is connected through a train of gears to a dial which indicates the frequency direct. The apparatus is small and portable, the base being 14 inches long and the total weight being 8.5 pounds. It may be operated from a 16 candle-power lamp socket.

Lecture-Room Demonstration of Orbits of Bodies Under the Action of a Central Attraction: By R. W. Wood. The apparatus consists of an electro-magnet with a conical pole piece projecting through a horizontal glass plate covered with lampblack. A bicycle ball is shot out upon this plate; its path is traced and a permanent record of its motion is thus obtained. Various orbits were thus determined.

The Refractory Index of Water and Alcohol for Alcohol and Electrical Waves: By A. D. Cole. This short note calls attention to the fact that the writer in a previous paper had not ignored the absorption of the Medium.

New Books: *Higher Mathematics*, Merriman and Woodward; *A Primer of Quaternions*, Hathaway; *Alternating-Current Machinery*, D. C. and T. C. Jackson; *Transformers for Single and Multiphase Circuits*, Kapp; *Méthode et principes des sciences naturelles*, Brentano; *Elements of Electro-Chemistry*, Le Blanc; *Motive Power and Gearing for Electrical Machinery*, Carter; *Mathematical Papers read at the International Mathematical Congress, Chicago, 1893; Laboratory Manual of Inorganic Chemistry*, Williams; *Chemistry at a Glance*, Tuttle; *Inorganic Chemical Preparations; The American Annual of Photography*, Thorp; *Problems and Questions in Physics*, Matthews and Shearer.

AMERICAN GEOLOGIST, MARCH.

O. W. Crosby and M. L. Fuller present the results of their investigation as to the 'Origin of Pegmatite,' or giant granite. The intimate association and evident close connection of pegmatite with undoubted plutonic rocks, and their agreement with the latter in composition and relations to the inclosing formations, have led many writers to regard the pegmatite itself as of plutonic igneous origin. It is also not long since geologists were united in the conviction that these were true vein rocks, due to the deposition of the various component minerals from solution in open fissures or other preexisting cavities. Now, however, a decided drift in the opposite direction may again be noted, and recent literature indicates an approaching agreement in favor of the association of the pegmatites, in their genetic relations, with plutonic igneous rocks rather than with subterranean aqueous deposits. The authors conclude that the magma of pegmatite may be formed by normal magmatic differentiation in a boss, or large body of magma, both crystallization and the operation of different temperatures in various parts of the mass tending to increase the degree of hydration of the residuum about favorable centers. These magma residues may crystallize *in situ*, in the midst of the previously solidified normal granite, or they may suffer extravasation and crystallize in spaces in the parent rock or in the surrounding formations. Also, apophyses of the normal granite magma may invade highly heated, water-bearing formations, such as schists, and experience the necessary hydration for conversion into pegmatite magma.

The correlation papers on 'The Galena and Maquoketa Series,' by F. W. Sardeson, end with this number. The basis employed has not been the usual one of computation of percentages among the various beds, but the limits, range, distribution and variation of the commonest species has been taken.

'Evidence of Glaciation in Labrador and Baffin Land,' by R. S. Tarr. All of the land, excepting possibly the highest parts, has been buried beneath an ice sheet. The glacial action produced more effect in the down-cutting of the surface in Labrador than in Baffin Land, and there is evidence that the ice has withdrawn from these regions in very recent times. Ice erosion has been greater in New England than in the northern region. On the other hand, proceeding northward, the effects of postglacial weathering become progressively pronounced, so that the recency of the ice uncovering is more and more marked.

O. H. Hershey has the first installment of a paper on 'Esker's indicating stages of glacial recession in the Kansan epoch in Northern Illinois.'

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON, 272D MEETING, SATURDAY, MARCH 27.

C. H. TOWNSEND spoke of 'The Distribution and Migration of the Northern Fur Seal,' giving a summary of the results obtained from a study of the log books of pelagic sealers, and illustrating his remarks by a chart showing the location of the seals on the Asiatic and American coasts at different seasons. The two herds, the American and the Asiatic, did not mingle, and the migrations of the former were much the more extensive of the two.

Charles Louis Pollard discussed 'What Constitutes a Type in Botany,' arguing in favor of recognizing multiple types when necessary. He suggested the abolition of the expression 'duplicate type,' on the ground that all specimens on which the original diagnosis is based must be of coordinate rank as actual types.

Lester F. Ward gave a 'Description of Seven Species of *Cycadeoidea* from the Iron Ore Deposits of Maryland,' saying that up to November 4, 1893, but a single species was known, based on four specimens collected by Philip Tyson before 1861. In 1893 Mr. Arthur Bibbins began work in the iron ore beds, under the auspices of the Woman's College of Baltimore, and up to the preset time he had procured no less than 59 specimens. These belonged to seven different species, but at present there was no reason to recognize more than the one genus *Cycadeoidea*.

F. A. LUCAS,
Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 260th meeting of the Society was held on March 2, 1897.

Dr. H. Carrington Bolton read a paper entitled 'The Language used in Talking to Domestic Animals.' He discussed the subject under the various animals controlled by man, dogs, horses, cattle, sheep, swine and poultry, and gave illustrations from nearly every country in Europe and every State in the Union. His essay, which elicited much discussion, will appear in full in the *American Anthropologist*.

The discussion was by Professor Lester F. Ward, W. H. Blodgett, P. B. Pierce, Dr. Frank Baker, Mr. Walter Hough, Dr. J. H. McCormick and others.

J. H. MCCORMICK,
General Secretary.

MEETING OF THE N. Y. SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE New York Section of the American Chemical Society held its regular meeting on March 5th.

The following papers were read:

'Note on the Volumetric Estimation of Lead,' by J. H. Wainwright.

'Electrolytic Production of Alkali Nitrites,' by Wm. M. Grosvenor.

'Method of Drying Sensitive Organic Substances,' by C. C. Parsons.

'Chemistry of the Sanitary Control of Milk Supplies,' by E. J. Lederle.

'Quantitative Separations by Sodium Nitrite,' by Gilette Wynkoop.

'On the Composition of Beet Sugar Ash,' by C. F. A. Meisel.

'Determination of Lead in Lead Ores,' by Richard K. Meade.

The meeting was well attended, and much interest was shown in the papers read.

DURAND WOODMAN,
Secretary.

THE GEOLOGICAL CLUB OF THE UNIVERSITY OF MINNESOTA, FEBRUARY 20, 1897.

MR. WARREN UPHAM read a paper entitled 'The Topography and Glacial Geology of the City of St. Paul.'

Attention was directed to the remarkable northeastward loop of the Mississippi river, here interrupting its general southeastward course. The rock formations beneath the drift have a horizontal stratification, being, in ascending order, the St. Peter sandstone, Trenton limestone and Trenton shales. The observed thickness of the shales is about 145 feet, their highest outcrop being 260 feet above the river or 945 feet above the sea. Above these bed rocks the glacial and modified drift deposits form the surface, and rise in morainic hills and smoother ridges from 200 to nearly 400 feet above the

river. The most noteworthy feature in the glacial geology of the area of St. Paul (comprising 55 square miles) consists in its deposits of modified drift at high levels, forming a group of plateaus of gravel and sand, rising with steep slopes to nearly flat upper plains 100 to 125 feet above the highest terraces representing the old flood plain of the river valley. These plateaus tell of a water level peculiar to this area; and the general contour of the region, the sigmoid course of the Mississippi, and two moraine belts, one of northeastern drift in the east part of the city, and another of northwestern drift in the west part, imply that this was the site of a glacial or ice-dammed lake, which is named *Lake Hamline*. The surface of the glacial lake during the early part of its existence, as shown by the Hamline and Como plateaus, was about 250 feet above the present river, or 930 to 940 feet above the present sea level. A little later, when the plateau a mile east of Lake Como was formed, the glacial lake level had fallen five or ten feet. Still later plateaus show that this lake finally was reduced to 875 or 870 feet above the sea. Its outlet was toward the southwest and south, across the present watershed between the Minnesota and Mississippi rivers, to Rich Valley and the Mississippi. The modified drift forming the plateaus has an aggregate volume of a tenth of a cubic mile, and it is thought to have been brought by streams from the englacial and finally superglacial drift of the waning ice sheet.

CHARLES P. BERKEY,
Secretary.

THE TEXAS ACADEMY OF SCIENCE.

THE regular monthly meeting of the Texas Academy of Science was held in the chemical lecture room of the University of Texas on Friday evening, March 5, 1897.

Papers were presented by Dr. E. F. Northrup, professor of physics, on 'Ether,' and by Dr. H. W. Harper, professor of chemistry, on 'A New Suggestion Concerning the Transmutation of Matter.'

Since the February meeting of the Academy the transactions for 1896 have been published, together with the proceedings, from its organization, January 9, 1892, to January 1, 1897, thus completing Volume I. This publication of 404 pages contains the constitution, lists of officers, patrons, fellows and members, thirty-four papers in full and seven abstracts. Of the papers and abstracts thirteen are upon geological or related subjects; six on mathematics; six on biological and allied topics; four on engineering; two on philosophy; two on education and culture; and one each on physics, language, ethnology and physiological chemistry; to these there must also be added four addresses of a somewhat general character.

As now constituted the Academy consists of two patrons, each of whom has paid into the treasury $500, thirty-four fellows and 197 members.

FREDERIC W. SIMONDS.

NEW BOOKS.

The Will to Believe. W. JAMES. New York, London and Bombay, Longmanns, Green & Co. 1897. Pp. xvii+332.

An Introduction to Geology. WILLIAM B. SCOTT. New York and London, The Macmillan Company. 1897. Pp. xxvii+573. $1.90.

Untersuchungen über den Bau der Cyanophyceen und Bakterien. ALFRED FISCHER. Jena, Gastav Fischer. 1897. Mark 7.

Zur Zoogeographie der landbewohnenden Wirbellosen. OTTO STOLL. Berlin, R. Friedländer & Sohn. 1897. Pp. 113. Mark 4.

Das Tierreich. I. Lieferung, Aves. bearbeitet von Ernst Hartert. Berlin, R. Friedländer und Sohn. 1887. Pp. 98. Subscription price, Mark 4.50.

First Principles of Natural Philosophy. A. E. DOLBEAR. Boston and London, Ginn & Co. 1897. Pp. 318.

Laboratory Practice for Beginners in Botany. W. A. SETCHELL. New York and London, The Macmillan Company. 1887. Pp. xiv+199. 90 cts.

La cause première d'après les données expérimentales. ÉMILE FERRIERE. Paris, Felix Alcan. Pp. 462.

The Phase Rule. WILDER D. BANCROFT. Ithaca, N. Y., The Jour. Phys. Chem. 1897. Pp. viii+255.